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ALL of the laws relating to interstate commerce, revised to this date, are this week published by *The Railway Age Gazette* in a pamphlet of about 150 pages. It is for sale at 50 cents each, or $4 a dozen. The form of this compilation is intended to be convenient for reference by operating, executive and legal department officers. It contains the full text of the acts, including revisions to this date. The different kinds of types used indicate at a glance the new requirements, the old requirements still in force and those expunged. The acts here given are: The Interstate Commerce Act (1887-1910), The Commerce Court (1910), The Elkins Act (1903-1906), The Act Relating to Testimony (1893-1906), The Expedition Act (1903), The Sherman Anti-Trust Act (1890), The Safety Appliance Acts (1893-1910), The Employers' Liability Act (1908), The Hours of Service Law (1907), Investigation of Block Signals, Etc. (1906-1910), The Accident Law (1910), The Ash Pan Law (1908), The Arbitration Act (1898), Transportation of Explosives (1909).

WITH the announcement that the New York, New Haven & Hartford has filed notice of what may be called its "local" increase of passenger rates, one of the most interesting ventures into the rate problem enters its initial stage. We have heretofore pointed out that the New Haven in the year 1906 reduced voluntarily passenger fares to two cents a mile on that large remainder of its system where the two-cent-a-mile rate had not before prevailed; and that, during the three years following, the gain in gross passenger receipts was $2,328,912, or nearly 11 per cent. Success in lowering rates is now to be tried out on the theory of another success by raising them. It is to be tried out, also, in the face of uncertainty raised by the continued retention of the two-cent rate on mileage books and the transfer of considerable business to the parallel trolleys of the steam lines—there being several hundred miles of such trolleys in Massachusetts, Rhode Island and Connecticut. That the increase of local fares, roughly estimated at about 18 per cent., will be a force making for decreased passenger traffic is obvious, and the only question is whether or not it will be more than made good by the higher fares. Prophecy on the subject wastes itself until the returns following July 23, the date the first instalment of the new fares comes, and there may be interferences affecting the fair out-working of the problem, with the spectre of federal action in the background. But barring such obstructive influences, there have been in our railway history few more instructive attempts than this of the New Haven to answer the old query, "What will the traffic bear?" without going beyond the bounds of a "reasonable" passenger rate and incurring the serious risk of some form of outside intervention. That the experiment is made on a system of great passenger density adds to its ultimate value.

SOME of the newspapers in their financial columns are calling attention, as indices of railway prosperity and credit in spite of the federal attitude, to the "marketing" of railway loans to the amount of several hundred millions since the opening of the present year. The statement calls for brief analysis. Accepting the figures for loans offered, the query follows how large a proportion of the loans are really "marketed"—that is to say, how large is the amount in the hands of actual investors and how large a part of them is still in the strong boxes of the underwriters. More pertinent still is the comparative *rate* of return to the railway corporations and to the investors as compared even with a year ago. What is the average discount which the railways must pay the underwriters? What is the higher rate paid the investor? Any solvent railway corporation entrenched behind a long dividend paying record can, of course, get its money if it is willing to pay enough. How long would the New York Central or the Pennsylvania Railroad have to wait for its money if it were willing to offer at par a loan bearing interest at a rate equal to its dividend? The real test is one of comparison; and when the railway bond houses complain of the sluggishness of the bond market; when the St. Paul goes abroad to borrow money at a rate considerably higher than 5 per cent., and when the high-rate short-term note of the high class railways again reappears, the loan market for the railways, as well as for other corporations, can hardly be described as receptive. The causes of this situation that bears

hard on railways seeking funds needed for improvements postponed by the panic-period are several, but the foremost of them are two: One is at home; namely, the higher cost of living that has compelled the host of small investors to seek the railway security that gives higher returns even with a slight edge of risk. The other cause is abroad, expressed tersely in this extract from a cable despatch from its London financial correspondent to the New York *Evening Post:*

"The feeling is that these recurring disputes between your government, your legislatures, and your financiers are very injurious to you. Europe considers, in fact, that much harm may be done your financial position by this constant nagging, which is far worse than actual speedy reforms."

It may be added, that the state of feeling expressed by the *Evening Post's* correspondent is not strictly limited to the other side of the Atlantic.

CAN POLITENESS BE TAUGHT?

THE politeness of American railway employees is nothing to brag of—although the passenger agent now and then does venture, in his advertisements, to "point with pride" in a cautious way. The behavior of ticket sellers and the men on passenger trains has undoubtedly improved during the past ten or fifteen years, but this improvement is not sufficiently marked or sufficiently general to warrant any definite conclusions. Officers whose duty it is to enforce courteous behavior still treat it too much as a secondary matter. The Delaware, Lackawanna & Western issued an admirable appeal to its employees a year or two ago, and other roads copied it; but an appeal does not fill the bill. Unless the Lackawanna is different from all other roads, there must be a large percentage of its men who need something much more definite than a circular. The Southern Pacific reprinted and circulated among its employees an article printed in this paper last November, in which numerous actual instances of incivility, boorishness and bad judgment were set forth in detail; but we cannot imagine that the article touched the consciences of more than one in a hundred of such of the company's men as were ill-bred, though it was, no doubt, very useful to those whose consciences were already active and who only needed a stimulus to their judgment. Another road on which the importance of politeness is well understood is the Chicago & Northwestern. An article on the subject from its employees' magazine was copied in the *Railway Age Gazette* (Feb. 25, page 419); and the editor of the magazine proposes to agitate the subject further.

All these things are useful, but after all they are only a scratching of the surface. The great difficulty is that this superficiality of treatment is almost a necessity. Many railway employees must be selected primarily for their efficiency in other things, so that one who sets out to perfect them in politeness finds himself handicapped at the outset. In a dry goods store or a hotel, ability to treat customers in a pleasing manner is a main qualification; but a station agent or a conductor, however helpful he may desire to be, finds only an extremely small percentage of the passengers needing him. In a store, every person that comes in must be attended to. In a railway station the agent or other representative of the road may do his full duty toward 99 per cent. of the passengers without saying a word. The employee thus cultivates a habit of mind that is not favorable to courtesy. He is engrossed in his work. At times, as in the case of long delays due to a washout or a wreck, nearly all of the passengers at a given place need help at once, suddenly imposing on the agent a strenuous task; and the chances are that he will not be equal to it.

In view of the difficulty of teaching politeness to men who either lack the desired instinct or in whom such instincts are smothered by the hard work that they have to do; and in view of the indifferent success that has attended the efforts which have been made in the past to improve this branch of the art of railroading, it is fair to ask the question, Shall we really make a determined effort to establish a high standard? Hitherto, and judging solely by results, it is not far out of the way to say that the answer is "No; do as well as is reasonably practicable, with the grade of men you have to deal with, and let it go at that." But no one formulates this view in words; and the only basis that can be found on which to put forth concerted effort is the view that *is* expressed by railway officers: Yes; we desire to attain as high a standard as possible. The question is, What is possible?

Why not supplement appeals and hints with measures to find out how far beneath the skin these have penetrated? A correspondence school, which succeeds in teaching something at arm's length, and which goes into details in a way that most railway superintendents seem never to have heard of, could give us innumerable points. It is a delicate subject, it is true. The trainmaster, himself, is likely to be far from Chesterfieldian in his manners. But why not consult a professor of deportment? This is not meant as a joke, but in sober earnest. We shall not attempt to develop the idea, but feel perfectly certain that it could be developed profitably in the brain of an ambitious superintendent or train master. Why is this any less practicable than to have surgeons educate men in first aid to the injured, or Col. Dunn teach them how to save lives by not dropping boxes of dynamite?

So many young employees are fairly polite without any training, having learned courtesy at home, that one may easily make the mistake of being content with circulars—or be still lazier, and be content with a couple of lines in the rule book—and rest in the assumption that "politeness costs nothing." This is true only in the most narrow meaning of the word "cost." Politeness does not necessitate the expenditure of any material thing. To the railway superintendent, however, who has several hundreds or thousands of men under him, all of whom should be polite to the passengers and other customers of the road, politeness is never inexpensive. He must try to get the maximum of politeness for the minimum of wages, and must go further, and seek executive ability and politeness combined, a combination which is never cheap. At best, many men must acquire a good deal of their knowledge about courtesy after they enter the railway service, and the question is whether to trust to their doing this satisfactorily on their own initiative or to try to systematize their efforts. One cannot draw his men up in line like soldiers and have them take exercises in making bows or putting on smiles, but the principle of the drill or of catechizing is essential nevertheless. In train despatching and the handling of train orders the use of hypothetical questions has often done much good. Why should not the same principle apply in the matter of courtesy? It may be said that being polite to passengers is a very different matter from safe-guarding their lives by enforcing obedience to the train despatching rules, but we need only a short conference with the advertising department to be assured that it is as important to keep passengers good-natured as it is to preserve their lives!

As an essential element in politeness is intelligent and alert interest in others' welfare, our topic includes something more than smiles and pleasant cadences; it may be said to cover the matter as well as the manner of the communication of a railway employee to a customer. Not long ago the manager of one of our principal railways was mortified to find that on the occasion of a 10-hours' blockade hundreds of passengers had been unnecessarily delayed very seriously by the omission of the agents and conductors to tell them how to reach their destinations by taking another railway or by private conveyance. These employees may not have lacked courtesy, but by reason of the neglect of themselves or of someone at headquarters, they lacked reasonable knowledge; and the disregard of passengers' rights was flagrant.

In cases where all trains are very badly delayed agents and conductors must offer advice even where the passenger is so much in the dark as not to know that he needs advice. He must be told the best way to reach his destination, even if thereby his money is turned into the treasury of a rival line.

The experienced agent, if he be of the proper temper, does this without instruction. All agents should be trained to do it. It is a serious damage to the reputation of a company if they do not do it. If such an emergency occurs only once in two years, or perhaps longer, the necessary training is not easy; but it is a duty just the same. The superintendent who neglects to train his agents and conductors to do their best in this matter may have in his own mind reasons for it; but all these reasons are unworthy. It is true that in the case of a big wreck or washout the traveler's troubles are largely inevitable, and must be put up with on the most philosophical basis possible. But the fact that the passenger has a ton of trouble that is incurable is no reason why all reasonable efforts should not be taken to relieve him of the additional half ton which can be cured. The fact that the railway company is not responsible for certain things is no reason for refusal to ameliorate the conditions as far as possible, without regard to the location of the responsibility. The superintendent cannot neglect to give information to the public on the ground that agents will make blunders and give passengers improper advice; this is simply one of the annoyances that must be put up with. Even where a blunder is made which causes someone a little expense and leads to the presentation of a claim for damages, the fact still remains that a railway company, in its own interest and for the promotion of its own popularity, should do the best that it can by its passengers with the best men that it has. If the mistakes made by the conductors and agents are too numerous, the fact indicates, not that the railway should shirk its obligation to the public, but that it should have a better class of men to deal with the public.

A PARADOX OF RAILWAY HISTORY.

THE now famous Sherman Act bearing the title of "An Act to protect trade and commerce against unlawful restraints and monopolies" is twenty years old, having been approved July 2, 1890. Notwithstanding the findings of the courts, not a few legal authorities hold that it was never intended to apply to railways, but to industrial and trade combinations. Its title tends to confirm that view and its other title in common parlance, "The Anti-Trust Act," has expressed the laical idea that it was intended to apply, fundamentally at least, to the trust combinations seeking to control commodities and especially the commodities that represent necessities of living—not the railways that supply transportation. But in its actual working the railways have borne the brunt of the act. The courts have not merely applied it thus far to the railways, but to them more forcibly and severely than to the trusts. It would be too much to say that an anti-trust federal statute has been transmuted by the courts into an anti-railway statute. But it is true that the railways have been its leading objects in court procedures from the trans-Missouri and Northern Securities cases down to the latest invocation of the law to enjoin the increase of freight rates by the western railways. There have been other legal procedures, like the sugar refining case and the two important suits postponed in the United States Supreme Court until next autumn. But, up to this time, the suits against the trusts, as compared with those against railway combination "in restraint of trade" have been incomplete and secondary.

Yet, of the two, the railways and the trusts, assuming that both were within the reach of the law, the lightnings of the statute should logically have struck the trusts first and hardest. The trusts, taking them collectively, have been by almost general consent one of the causes of the increased cost of living. How far they share that credit with such other elementary causes as personal extravagance, larger production of gold, the tariff, limited farming and other influences, there is no way of accurately finding out. But the Sherman act was aimed at them primarily; and certainly the great expansion of the trusts at a period some ten years ago, followed by the public outcry against them, was not a fact of a nature to divert federal action and turn it against the railways. The trusts, as stated, have many of them not only affected the necessities of life, but have aimed at control of prices throughout the whole country and in some cases have succeeded in doing so. The railways, to be sure, have formed their combinations. But those combinations have in no case been on a national scale. They have been grouped and outlined within certain distinct territorial bounds. Again, unlike the trusts, the railways have not raised their prices, but have diminished them. And, finally, while the railways have been under the checks and restraints of public supervision, compelled by law to make returns and face a certain civic and fiscal responsibility, the trusts have been under no such restrictions. Surely, reasoning from such premises, it was the trusts and not the railways that should have first drawn statutory fire. The trusts should normally have been a lightning rod for the railways, instead of the reverse that has come to pass.

This historical paradox—for it is already historical, though its history is not yet ended—is hard to understand fully, though it has its clues. If one seeks the leading cause it is probably the publicity which the railways have been forced—and not unwisely—to face. Their publicity is not complete, nor can it ever be. There are railway affairs and doings, many of them minor, but some of them major that cannot be blazoned abroad. The idealized condition where two railway presidents meet to make a "deal" and instantly proclaim the fact will never be attained until human nature and political economy are reconstructed. Still it remains true that, as compared with the average and strong trust ranging all the way from a New Jersey corporation with wide and flexible powers down to a "gentlemen's agreement," the railway represents ultra publicity; and that very publicity with its display of facts—such, to use the most recent case, as the filing of rates a month ahead—opens it to the attacks of law. A quality which, in its most generalized sense, is a virtue, becomes a legal infirmity. The small or uncertain offense, the offense which must pass through the courts before it is determined to be an offense at all, the offense which in the case of the trust goes undiscovered hales the railway into court. The same paradox comes to pass in the court of public opinion. In that fierce light which beats upon the railway, the eye of the citizen sees habitually and repeatedly under the publicities exacted by law, things, good or bad, that the non-public service corporation screens. The citizen's vision of the railway is direct. As bearing on the trust, though naturally the first target of the Sherman act, the citizen's vision is almost necessarily oblique.

Hence the strange historical paradox in the operation of the Sherman act by which the minor has superseded the major, publicity has been chastised harder than sublety, the agent that has reduced prices to the consumer more sharply disciplined than the agent that has raised them, and the railway made not only the prime objective of a federal "anti-trust" statute enacted twenty years ago, but just now of a fresh statute still further restrictive and without repeal of the act of 1890. The anomaly would be more diverting were it invested with fewer elements of possible economic tragedy.

THE NEW EPOCH IN RAILWAY AFFAIRS.

THE results of any law are apt to depend more on how it is administered and obeyed than on its provisions. The statutes against murder in the western states and territories in pioneer days were very good laws; but as there were many who chose to disregard them and public sentiment was rather lax as to their enforcement, they did not contribute much to the peace and order of society. The original act to regulate commerce was a good law. If it had been enforced and obeyed according to its spirit it might have solved the "railway problem." But the railways elected habitually to disobey it, and the Interstate Commission and successive federal administrations enforced it but flabbily. The public, failing to see that the real trouble was not lack of laws, but weak administration of them, called for more legislation; and so within the last seven years we have had the Elkins act, the Hepburn act, and the

various measures passed this year, the most important of which is that amending the Interstate Commerce act.

While this new "rate law" is in its infancy it is a good time for all directly affected to consider earnestly, and perhaps even prayerfully, what they are going to do about it. The country has taken giant strides along the path of government regulation during the last few years. The enactment of this law is one of the longest of them. It gives the Interstate Commission a control over the initiation of railway rates such as ten years ago no one but a Populist would have proposed. It does not necessarily follow that it will either hurt or help anyone. Like the previous laws to regulate interstate commerce, its effects will depend mainly on how it is administered and obeyed.

The present personnel and temper of the Interstate Commerce Commission encourage optimism. When the Hepburn act went into effect four years ago the commission was reorganized by the appointment of four new members. None of them had expert qualifications. Some said and did things for awhile that drew criticism from and caused alarm to both shippers and railway men. It was whispered that certain of them had not doffed their interest in politics when they put on the duties of commissioners. But they are all men of ability. Study and experience have increased and ripened the knowledge and wisdom that they bring to their intricate and important duties. The present temper of the commission probably is about as fair as that of any body of men can be who hold offices such as theirs in a country where public sentiment towards railways is what it is here. They appreciate the magnitude of their increased duties and responsibilities—duties and responsibilities in some instances much greater than they sought. No body of men could wield such powers as they now have in a way that would avoid frequent error and criticism. But if the shippers and railways give the commission a fair chance it is probable that with its ripened wisdom and increased sense of responsibility it will arbitrate with approximate justice between them.

Until very recently it looked as if shippers as a class would insist that the earnings of railways be restricted within the very narrowest limits that the law will permit. Their attorneys contend that rates constitutionally may be reduced and held down to a point that barely avoids confiscation; and it seemed that most of them were going to insist on having their pound of flesh. The success of the mediatory efforts of J. P. Morgan & Co. in getting the meat packers to agree to raises in their rates is a ray of sunlight. The large packing industry having been convinced that the prosperity of the country as a whole is not to be increased by arbitrarily limiting the returns of one of the largest industries of all gives occasion to hope that other shipping interests may be led to see the matter in the same light. It ought to be plain to every thinking business man that the profits of any one industry cannot be arbitrarily restricted while the profits of other concerns are not limited without inviting disaster. The public can perhaps determine what return shall be earned on the present investment in railways; but it cannot compel future investments in them. Each investor will insist on having the profit to which he thinks he is entitled, regardless of public opinion on the subject; and the effect of providing that only a small return shall be derived from the railway or any other business will simply be to divert investment from that business to other businesses whose profits are not limited.

For the passage of this new legislation the railways themselves are in a negative sense largely responsible. They have never obeyed the laws so well as in the past four years. But their course before that was in many ways adapted to incur public hostility, and their managers have since shown a singular incapacity to deal with public sentiment. We have many great railway executives; but the experience of the last few years, in which the roads have been whipped in almost every battle that they have fought with the shippers and the politicians, shows that we have few railway statesmen. It might have been much harder to have passed the additional restrictive laws if the railways had not been divided among themselves. But at the very inception of the administration's campaign for more legislation the executives of some lines which were especially anxious to get legislation to legalize existing combinations of competing roads are said to have indicated to President Taft that if he would favor legislation of this kind they would not vigorously oppose his other projects. The President did recommend the legislation they desired, but could not get it passed. Meantime when the amendments to the Interstate Commerce act were being considered the railways failed to make adequate appearances before the senate and house committees by witnesses representing them either as a whole or in any considerable number; and consequently the bill was reported by committees and weighed by a public which never had heard the railway case fully presented from different points of view. The ablest opposition to the important provision giving the commission power to restrain advances in rates came not from the railways, but from the Railway Business Association. In view of these facts it is not surprising that the law passed contains none of the provisions of the administration's original bill which the railways wanted, and all of the provisions which they did not want, except that giving the commission power to regulate the issuance of securities, with the addition of several radical clauses which were forced into it by the "insurgents."

Now that the Mann-Elkins bill has been passed it is to be hoped that the railways' course in reference to it will be more statesmanlike than was their opposition to it. Recent decisions of the courts concede to the commission very large powers. Government regulation is rapidly ceasing to be a matter of legal technicalities and becoming almost wholly a question of public expediency. No one will blame the roads for contesting any provisions of the act or orders of the commission that they believe unconstitutional. But their wisest course in future will be to try to work more with the shippers and the commission and less against them. It is high time for the commission, the shippers and the railways to strive very hard to "get together." They have some conflicting interests. But they have one paramount interest in common. This is in the development of good and adequate facilities of transportation. And the development of these facilities is not going to be promoted by the continuance of the incessant bickerings and conflicts of recent years. More important still is it that the railways shall try to get closer to the public. How the Interstate Commerce Commission will administer existing laws, and whether there will be more regulatory laws, will depend on public opinion; and what public opinion will be will depend very much on what the railways do to conciliate and educate it. Public sentiment will be best educated by consistently telling the public the plain truth about the railway business; and, of course, if the facts are to be told the roads must so conduct themselves that there will be the fewest practicable number of facts to tell of which they will be ashamed.

With the wages of labor and other expenses of railway operation rising; with the roads struggling to increase their rates; and with new laws imposing added restrictions and duties on railways and giving the commission greatly enlarged powers, the present marks an epoch not only in the history of transportation, but perhaps also in the history of industry and government in this country. In previous attempts to solve the railway problem most of those directly interested have shown more disposition to follow a familiar parody of the Golden Rule—"Do others as they would do you, and do them first"—rather than to follow the rule itself. The Golden Rule, however, is the summation not merely of piety, but also of common sense; and if the commission, the shippers and the railways could be persuaded to try earnestly to apply it to present conditions, the satisfactory solution of the problem might be brought nearer. On the other hand, if they continue to apply the parody of the rule there is apt to be created a situation relief from which the country may seek by throwing itself into the socialistic arms of government ownership.

NEW BOOKS.

Comparative Analysis of Railroad Reports. H. H. Copeland & Son, New York. Seven charts, bound separately in folders, 10 in. x 5½ in. Published annually.

This set of charts shows the income account, profit and loss account, balance sheet and important physical and traffic statistics for 110 railways, 80 for the fiscal year ended June 30, 1909, and 30 for the calendar year ended Dec. 31, 1909. The figures given show not only the total amount of the various accounts as given in the annual reports of the railways, but they are also worked out on unit bases to afford comparisons between the different roads. Each chart contains figures for a group of roads operating in the same section of the country and presumably under more or less similar conditions. The object of the analysis is to reduce the figures to units which are logically comparable for different roads. Earnings, for instance, are given on a per mile operated basis, on a per revenue train-mile basis, and on per ton-mile and per passenger-mile bases; and the same kind of painstaking comparison is made between different classes of expenses. The balance sheet shows capitalization on a per mile-owned basis. Before the classification of revenues and expenses prescribed by the Interstate Commerce Commission was put into effect it would have been impossible accurately to compare in detail a number of roads in the way that the Copeland analysis does. Now, even since the adoption of the classification by all important roads, it would take a skilled statistician many hours, if not days, to make as careful an analysis of a single road's annual report as is made for each of these 110 roads. One entirely unfamiliar with the form and meaning of railway accounts could not learn anything in particular from these comparative analyses. They should be, however, of very great value to those who understand the meaning of railway accounts, and their value increases in proportion to the greater knowledge that is possessed by the one who uses them.

Probably there are no unit figures of comparison between different roads that are entirely satisfactory, but having at one's command unit figures for a great number of roads adds immensely to the accuracy with which one can judge of the earning power, adequacy of maintenance expenditures, financial condition, etc., of any one given road. For instance, it may mean comparatively little to know that a given road spent $600 for repairs and renewals of passenger cars in a given year, but if this unit figure can be readily compared with the sums spent by a number of other roads operating in the same territory, and under like conditions, the figure for the given road takes on some meaning. The entirely unique feature of the analysis is the care and thoroughness with which figures are reduced to units that have a real meaning, as, for instance, in the case of repairs and renewals of equipment, which figures are shown not on a basis of mileage operated, which is entirely illogical but is nevertheless often used in making comparisons, but on a basis of cost per unit of equipment and cost per mile run per unit of equipment. Besides this unique feature the analysis gives figures that are uniform, both for what they represent and in their method of derivation, a result that would have been impossible before the railways were compelled to make returns to the Interstate Commerce Commission.

The charts should prove of great value to the statistical department of any bank or bond house dealing in railway securities, and should also be of much use to the higher officers of railways, more especially to higher financial officers, but also to the higher engineering and operating officers. The work is in a class entirely by itself as far as we know. Manuals containing railway and industrial statistics are avowedly for reference only, and it is necessary to go to the annual reports or to the returns to the Interstate Commerce Commission to get more detailed figures. In the Copeland analysis all the essential figures that most railway reports contain are given and in addition there is a wealth of information in the form of derived figures that lays before one facts from which it is possible to form an intelligent judgment about a property.

Letters to the Editor.

LOCOMOTIVE HEADLIGHTS.

Trenton, N. J., June 22, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In the article on Locomotive Headlights, in your issue of June 20, you say that the original purpose of carrying a light at the head end of a locomotive was probably to enable the engineman to see obstructions on the track ahead.

Is this historically correct? It has always been my opinion, and I believe that the history of the locomotive headlight on English railways will corroborate it, that the original purpose of the locomotive headlight was simply to indicate the front end of the train, or, if you prefer, the direction in which the train was moving.

From my own railway experience, I am also of the opinion that to-day the primary use of the headlight is to indicate the direction in which the train is headed, and that any assistance that the headlight may be to the engineman in enabling him to see obstructions on the track ahead is incidental rather than essential.

ALEX. P. GEST.
Superintendent.

DISTANT SIGNALS THAT ARE TOO DISTANT.

Chicago, June 17, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In your criticism June 10 of my remarks on distant signals, I think you were acting under a misapprehension. What I had in mind in saying that the distant indication might be valueless if placed too far away from the home signal, was the situation where such distant indication is from two and one-half to five miles away, as quite frequently happens, especially on single track. I believe that you will agree with me that in such cases very little dependence can be placed on the distant indication. I do not consider 4,000 or 5,000 ft. an excessive distance.

As to the matter of handling trains of different speeds and classes, you will see what my ideas on the subject are by referring to a letter of mine which you published some time ago. This was illustrated with several diagrams showing signal aspects.

I think a careful reading of my article will show that what I recommended as best practice was the use, where blocks must necessarily be very long, of intermediate distant signals; and that I merely suggested that possibly in some cases it might be as well to omit the distant indication altogether. I could refer to several roads where such practice is consistently followed.

W. H. ARKENBURGH,
Special Engineer, Rock Island Lines.

Chicago, June 20, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have read the article in your issue of June 10, by Mr. W. H. Arkenburgh, on "The principles governing the arrangement of automatic block signals." There are some good points in this article, but I would particularly criticise that part of it relating to distant signal indications. I am inclined to the opinion that his statements are his own personal deductions rather than something supported by any operating officer with whom he may have come in contact, as your editorial suggests. Several western roads have installed three-position signals, and others are beginning to do it; and certainly Mr. Arkenburgh's statement, that the distant signal ceases to be of practical value and is an absurdity, is not a fact borne out by the results obtained on the Rock Island road, where three-position signals have been in use for some years on lines of both heavy and thin traffic and where a large number of this particular type of signal is being installed every year.

A. G. SHAVER,
Signal Engineer, Rock Island Lines.

PROFITS OF AMERICAN RAILWAYS, AS ILLUSTRATED BY THE ILLINOIS CENTRAL.

BY HOWARD G. BROWNSON, PH.D.,
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At the present time there is a widespread feeling throughout the United States that incorporated industries are receiving excessive profits at the expense of the general public. The railways, on account of their public nature and their monopolistic character, have been singled out for especial criticism. In a specific way this attitude has found expression in heavily increased taxation and a persistent demand for material reductions in both freight and passenger rates.

The strength of the movement lies in its vagueness. The press and public speakers have flooded the country with general statements accusing the roads of receiving larger profits than they should, and these accusations are believed by large portions of the population. The saying goes, "Where there is smoke there is fire," and despite the vague and general character of many of the charges and the sensationalism of popular writers there is ample evidence to show that the owners of not a few roads, for example, the Union Pacific, have received handsome returns on their cash investment.

Nevertheless, the careful student of railway capitalization must ask the question, Are all the elements of the problem taken into account even in the flagrant cases of stock watering? A half truth is often more dangerous than an absolute falsehood and the calm judgment of the American people should insist on examination of railway capitalization that takes into consideration all the factors. Then, and then only, has the public a right to make a decision.

Unfortunately, the history of American railway finance has been so checkered that it is almost impossible to-day to extract from the maze of stock and bond issues a correct statement of the present cash investment in our transportation system as a whole. Stock watering, necessary and unnecessary discount on securities, capital expenditures made from income, tremendous obsolescence of property due to progress and improvements, accompanied by equally great appreciation of real estate, poor accounting, and unwise, sometimes fraudulent, financial management, all have combined to make any estimate of present cash investment a Chinese puzzle.

While reasonable knowledge of investment in railway transportation is impossible for the roads as a whole it is not for a few conservatively managed and operated systems such as the Pennsylvania, the Chicago & North Western, the Burlington and the Illinois Central. In systems of that type a careful and detailed study of the mass of data contained in published reports should establish with a reasonable margin of error the approximate cash investment in the property and the net return to the different classes of investors. After all, it is unlikely that a marked difference should exist in the return on cash investment made on different large systems in the same territory for a period of, say, fifty or sixty years. Stock watering and errors in accounting can affect only the nominal returns.

Of the various large roads just mentioned the writer has chosen the Illinois Central Railroad for two reasons. In the first place, during the past four years he has made a careful study of its history and of its traffic, operating and financial statistics for a history of the system now in preparation. In the second place, the Illinois Central is typical of what is best in American railway management. It has had a continuous history of slightly over sixty years. Its management, especially in financial matters, has been conservative; it has been operated solely in the interest of its shareholders and of the public; its sound credit has enabled it to acquire dependent lines at reasonable prices and on a cash basis; and, above all, the accounting systems of the parent and most of the acquired lines have been reliable, reasonably accurate, fairly detailed and kept in accordance with the best practices of the times.

Moreover, such a study is of more than ordinary interest on account of the typical character of its territory. The Illinois Central, extending as it does from Omaha and Chicago on the north to New Orleans and Savannah on the south, includes a territory where differences in climate, population, physical conditions, business methods, industrial pursuits, nature of traffic and standards of operation make the returns of the road fairly typical of the country as a whole.

The primary object of this study is to ascertain just what has been the cash investment in the undertaking and what profits the owners have made on their cash investment. The legal organization of the system is rather complicated and in its public reports there has been a considerable amount of error, omission and duplication. For the sake of simplicity the statistics are confined to those lines operated directly by the Illinois Central Railroad Company (excluding the Yazoo & Mississippi Valley, the Indianapolis Southern and the Central of Georgia) a total of 4,550.54 miles, and the balance sheet and income accounts have been rearranged so that assets, capitalization and income cover the same mileage. As indicated later, the assets have been placed on what is practically a cash basis while discounts, stock dividends, etc., have been eliminated. In brief, the aim has been to rearrange the accounts as if the Interstate Commerce Commission classification of accounts had been in effect since 1851.

At first sight it seemed utterly hopeless to adjust to that standard accounts of some fifty odd corporations extending over a period of sixty years, especially when poor accounting methods or destruction of reliable statistics made most of the reports almost worthless. However, as the figures have been patiently examined it has been possible to secure results with the probability of only reasonable error.

The annual reports of the companies to their shareholders, to Poor's Manual of Railroads and to the state and federal railway commissions have been the basis of estimates. Those reports are of three kinds: (a) those of the I. C. R. R. Co. proper; (b) those of subsidiary lines built by the I. C. R. R. Co.; (c) those of subsidiary lines purchased or leased by the I. C. R. R. Co.

The annual reports of the I. C. R. R. Co. give detailed information as to all construction work and improvements handled by that company and as to cash received from practically all securities sold directly to the public. From them it has been possible to secure an itemized statement of the cost of the I. C. C. R. R. proper (705.5 mi.) and capital expenditures on acquired lines (except D. & S. C.) after acquisition, cash paid in by shareholders, net receipts from sales of land grant, net increase applied to capital account, and cash received from I. C. R. R. mortgage bonds. These statistics agree with the sworn statements submitted to the Illinois Railroad and Warehouse Commission and to the Interstate Commerce Commission, and all accounts prior to 1876 were carefully examined by a special committee of English and Dutch stockholders.

In addition to the itemized expenditures of the I. C. R. R. Co. there exist complete statements of the cost of the subsidiary lines built directly by the I. C. R. R. Co. These statements can be found in the offices of the Iowa, Wisconsin and Illinois railway commissions or in reports of the Illinois Central.

These two sources cover $229,163,229.52 out of the estimated assets of $316,543,690.56; and, unless there is actual fraud in the accounts of the corporation, may be taken as substantially correct.

The accounts of subsidiary roads built independently of the Central and subsequently acquired are a serious source of error. In practically all instances, however, an itemized statement of original cost of construction was secured. With those statements as a basis all subsequent changes in the balance sheet were carefully checked with amounts received from sale of securities, increases in equipment, improvements in right of way and construction account, growth of both gross and net earnings, market value of property, etc., etc. Rough approximations of probable cost of construction were made and any variations from this standard were examined. Maintenance charges per unit of equipment or track were checked

up. Where evidence showed a depreciation of property the assets were written down in a liberal manner. In the case of the southern roads very heavy amounts were written off for depreciation during and after the civil war. Since the cost of a given amount of equipment is easily ascertainable and since right of way and terminal construction in a level country will have a cost somewhere between known maxima and minima, any padding of construction or capital accounts of material extent becomes evident. Thus, by checking the expenditures of one road against those of other roads in similar territory a further check was obtained. Moreover, when the companies were purchased by the Illinois Central the estimated valuation of assets had an additional check in the cash or cash equivalent price paid by the purchaser. The writer, so far as he has willingly erred, has erred on the side of conservatism, and it is his opinion that many of the statements are too low.

The total estimated cost of these acquired lines at time of purchase amounted to $87,380,461.04, or approximately $11,000,000 in excess of the cash investment of the I. C. R. R. Co. Against this should be set approximately seven to eight millions of net earnings applied to construction account during the period of reorganization and not taken into account in the company's reports. Since all the lines, with the exception of the Dubuque & Sioux City and the St. L., A. & T. H., were purchased at foreclosure sale, mostly at a time of panic, it is reasonable to infer that the original investors lost very heavily, particularly in the case of the southern lines.*

On the whole, the greatest source of danger lies in depreciation of property. The writer has no hesitation whatever in saying that the total investment in the system charged to capital account is considerably in excess of even his figures. The lines, particularly since 1890, have been kept up to the best standard of American maintenance, but no one can say whether that is sufficient. Personally, the writer believes the actual cost of duplication on the Illinois Central would run from 20 to 25 per cent. or more below original investment, but if that is true it would apply with greater force to the roads of the country as a whole. The great appreciation of real estate, however, would more than balance any depreciation. For the system the writer hazards an estimate of $50,000,000 as the present value of the real estate of the corporation in excess of original cost.

As an independent check on the capital expenditures the writer made an estimate of the receipts from securities, income, land, etc., as reduced to a cash basis. Perhaps the best proof of the accuracy of the work is the fact that the estimates of capital expenditures and capital receipts, each made entirely independent of the other, balance within two and a half million dollars, or under 1 per cent. Since practically all securities of the I. C. R. R. Co. were placed at the best current market rates without stock bonuses or other devices of poor credit, the discount is a negligible factor. Three per cent. and 3½ per cent. bonds were sold at discounts of from $50 to $300 per bond, but this is only a nominal discount, since the saving in interest is supposed to eliminate the discount by the time the bonds mature. Practically, the capitalization is without water except for less than $6,000,000 of stock dividends distributed prior to 1869.

With these explanations let us now take up the statements showing the capitalization and return on cash invested in the system. Table 1 is a statement of the cash value of assets for the operated mileage and the par value of securities outstanding in the hands of the public.†

TABLE 1.‡—*Assets and Liabilities, June 30, 1909.*

Assets.		
Capital Assets—Railway and equipment	$269,786,406.00	
Bonds	18,422,062.00	
Stocks	3,772,324.06	
		$291,980,792.96
Current Assets		$13,577,693.58
Deferred Assets		2,549,642.92
Contingent Assets		8,435,561.10
Total Assets		$316,543,690.56
Liabilities (In the hands of public.)		
Capital Liabilities—Capital Stock	$109,273,960.00	
Leased line stocks	9,989,800.00	
D. & S. C. stock	33,300.00	
Stock	$119,297,060.00	
Funded debt, Illinois Central R.R.*	$119,899,000.00	
Funded debt, C., St. L. & N. O.	16,154,000.00	
Funded debt, D. & S. C.	2,766,083.80	
Funded debt, C., A. & N.	50,000.00	
Funded debt	$138,166,143.80	
		$258,166,143.80
Current Liabilities		9,324,383.90
Deferred Liabilities		3,047,413.46
Contingent Liabilities		1,283,001.89
Miscellaneous—Miscellaneous funds	$6,454,289.53	
Surplus	38,268,457.98	
		44,722,747.51
Total Net Liabilities		$316,543,690.56

*Excludes $25,000,000 4 per cent. collateral trust bonds of 1953, representing investment in Yazoo & Mississippi Valley R.R.

For the operated mileage, therefore, the net liabilities in the hands of the public are less by nearly $45,000,000 than the cash value of the assets exclusive of real estate appreciation. Since the present liability of 3 per cent. and 3½ per cent. long time bonds is under their nominal par the real surplus is very much larger.

Table 2 shows the net cash receipts of the system applicable to capital amounts and the sources of expenditure. Allowance has been made for refunding operations, and securities used to purchase subsidiary lines are rated at equivalent cash price.

TABLE 2.—*Cash Receipts and Expenditures on Capital Account—March 20, 1851, to June 30, 1909.*

Receipts.		
Capital stock—Illinois Central R.R.	$103,858,740.00	
Capital stock—C., S. L. & N. O.	2,000,000.00	
		$105,858,740.00
Funded debt*		140,901,720.00
Net income		50,480,719.00
Miscellaneous liabilities		16,983,099.00
Profit on subsidiary lines		11,824,754.00
Total Receipts		$326,048,832.00
Expenditures.		
Construction account		$269,786,406.00
Stocks and bonds		22,194,386.00
Miscellaneous assets		31,310,619.00
Miscellaneous		2,757,421.00
Total Expenditures		$326,048,832.00

*The difference between this item and the nominal net funded debt is due to the retirement of $17,000,000 construction bonds by receipts from the land grant.

It is interesting to note that the shareholders either directly or indirectly have provided over half the entire receipts, although the nominal net debt exceeds the capital account (including leased line stock) by over thirty millions.

In the year 1909 the income account stood as follows, excluding duplication due to inter-system accounting:

TABLE 3.—*Income Account.*—Year ending June 30, 1909.*

Net operating income	$13,454,229.76	
Income from investments	697,850.86	
		$14,162,080.62
Fixed charges		5,713,078.08
Surplus for the year		$8,449,002.54
Dividends		7,752,995.50
Surplus above dividends†		$696,007.04
		Per cent.
Earned on total investment.‡		4.48
Net earnings from operation applied to capital acc't.§		4.79
Paid on total investment		4.26
Paid on capital account		4.79
Average rate interest—par outstanding.¶		3.92
Average rate interest—cash dividend.‖		4.39
Dividend rate		7.00
Dividend on cash invested by shareholders		7.39
Dividend on cash plus accumulations of net income		5.04
Applicable to dividends on cash invested by shareholders		8.14

*Excludes income received from subsidiary companies.
†This surplus exceeds that given in the annual report by $162,890.27, most of which is represented by net earnings expended in D. & S. C.
‡Total income applied to balance sheet statement of assets.
§Net earnings from operation applied to construction account plus cash, supplies and other strictly cash assets.
¶Fixed charges less sinking fund charges, rentals of line and interest paid on money borrowed.
‖Excludes from funded debt $14,000,000 retired by receipts from land grant.

*This covers a mileage at time of purchase of something over 2,500 miles of main and branch lines.
†Securities in various trust funds are regarded as in the hands of the public.
‡This and subsequent tables cover merely the mileage operated directly by the Illinois Central R.R. Co.

Considering that the average rate of interest on good investments such as P. R. R., U. P. R. R. or I. C. R. R. 4 per cent. bonds for 1909 was over 4 per cent., the above shows that the net return on the investment in the Illinois Central was not particularly remunerative. A single year, however, is a very poor criterion of a company's earning capacity, and to show the profits of the railway there is attached Table 4, which gives the net results for 52 years from 1858 to 1909.

In this table, capital account includes construction account (*i. e.*, railway and equipment) plus supplies, cash and miscellaneous assets of tangible character, but not securities, paper or other forms of non-tangible assets.

Col. A—Net earnings from operation applied to capital account.

Col. B—Dividend rate.

Col. C—Net income applicable to dividends applied to cash invested by shareholders.

Col. D—Dividends paid applied to cash invested by shareholders.

Col. E—Dividends paid applied to bid, plus accumulations of surplus, i.e., equity of shareholders.

Table 4.—*Return on Investment.* (See Notes below.)

	Per cent.				
Year.	A.	B.	C.	D.	E.
1858	1.55	..	*6.65	.....	.....
1859	1.78	..	*4.32	.....	.....
1860	3.02	4	0.67	0.71	0.71
1861	4.04	4	1.96	1.88	1.68
1862	5.39	4	4.81	2.08	2.08
1863	6.75	6	9.95	5.17	5.17
1864	7.33	8	12.32	8.00	8.00
1865	6.47	10	10.23	10.77	10.77
1866	6.37	10	9.95	11.85	11.85
1867	7.22	10	13.43	11.85	11.85
1868	7.15	10	13.24	11.85	11.85
1869	8.45	10	15.21	12.80	12.80
1870	7.52	10	14.45	12.80	12.80
1871	6.96	10	12.48	12.80	12.80
1872	5.73	10	8.46	12.80	12.80
1873	7.35	10	13.10	12.80	12.80
1874	6.97	8	10.98	9.95	9.95
1875	6.91	8	9.60	9.95	9.95
1876	5.72	8	7.21	9.95	9.95
1877	6.40	4	8.91	4.97	4.97
1878	7.04	6	10.50	7.48	7.30
1879	7.38	6	11.83	7.48	7.11
1880	7.95	6	13.06	7.48	6.82
1881	7.32	7	11.94	8.73	7.60
1882	7.72	8	14.90	8.73	7.35
1883	6.90	8	15.91	9.95	7.81
1884	6.21	10	13.06	12.48	9.55
1885	6.11	8	12.07	8.95	7.36
1886	5.92	7	11.40	8.73	6.33
1887	5.89	7	12.91	8.33	6.55
1888	4.23	6	6.80	6.95	5.37
1889	4.69	3	3.87	3.47	2.69
1890	4.48	6	7.59	6.95	5.36
1891	4.17	5	5.68	5.69	4.51
1892	4.07	5	5.73	5.69	4.50
1893	4.45	5	5.89	5.62	4.55
1894	4.83	5	6.65	5.62	4.54
1895	4.36	5	5.66	5.62	4.49
1896	4.80	5	6.57	5.58	4.41
1897	4.24	5	5.92	5.58	4.48
1898	4.93	5	9.33	5.58	4.46
1899	4.75	5	9.21	5.53	4.34
1900	5.08	5.05	10.59	6.04	4.74
1901	5.41	6	11.62	6.58	4.85
1902	5.83	6	13.08	6.46	5.03
1903	5.68	6	11.99	6.38	4.96
1904	5.01	6	9.90	6.38	4.75
1905	5.57	7	11.31	7.42	5.39
1906	5.88	7	12.12	7.42	5.15
1907	6.37	7	13.01	7.42	5.07
1908	4.74	7	8.92	7.42	4.89
1909	4.79	7	7.88	7.39	5.04
Average	5.69	6.62	9.48	7.60	6.61

*Deficit.

Columns B, D and E, interest dividend on full paid stock 1860-1863, 1889—half year ending June 30th, 1889.

Owing to changes in fiscal year, an extra dividend of 4 per cent. should be added to the table. (This is taken account of in the average.)

Column 1877 marks the beginning of the real accumulation of surplus earnings. Prior to that year current surpluses and deficits balanced each other.

The next query is: How much is the property worth at the present time? There can be no better standard than that of the stock market. At date of writing, March 31, 1910, Illinois Central stock is selling for 140, or $153,014,400 for the 1,092,960 shares outstanding; just $49,155,660 more than the cash actually paid in. This price is considerably under the average of the past ten years. In other words the shareholders, i.e., the owners, of the Illinois Central have received, during the past 52 years, an average dividend of 7.6 per cent. on the cash actually invested and in addition have a property worth at least $50,000,000 more than that which they put into it.

It should be noted, however, that a large share of this surplus is due to the original federal land grant. The federal government, through the state of Illinois, gave the railway 2,500,000 acres of land to have a direct rail line from Chicago to Mobile. Had it not been for this aid the road would not have been built for at least a decade, perhaps never, and the profits from this grant must be regarded as a bonus given by the government for military and political reasons. From 1851 to 1906 the company received from the land grant a net total of $27,725,689.29. In return the state of Illinois has received from $250,000 to $700,000 a year in taxes (7 per cent. charter tax) over and above the average paid by other Illinois roads. Allowing for enhanced credit, interest on receipts from grant in excess of payments to the state, etc., etc., the land grant might be regarded as responsible for $20,000,000 to $25,000,000 of the surplus.

Omitting this special feature, which is not applicable to most of the roads east of the Mississippi river, the profits of the shareholders may be stated as an average dividend of 7.6 per cent. and a surplus derived from railway rates of from $25,000,000 to $30,000,000.

Whether this seems large or small depends on the viewpoint of the reader. To a banker accustomed to 10 per cent. or 15 per cent. dividends and a surplus of 100 per cent. to 1,000 per cent. this is very small; to the investor in 3 per cent. government bonds it spells extortion and exploitation of the public. Every profit, however, is largely relative and it is so with the profits of the railway. To do justice to the corporation and the public it may be well to judge the returns by a threefold standard: (1) the service of the railway to the public; (2) the methods by which the road has secured its profits; (3) the profits of other industries in the territory.

The easiest statement of the service of the railway is to compare the Mississippi Valley in 1851 and 1909. In the earlier year Illinois had a population of 850,000 scattered along the navigable streams. The remainder of the Mississippi Valley was settled to about the same extent. Agriculture carried on in isolated farms or plantations was the well nigh universal rule. The yoke of oxen and the flatboat were the means of transportation, and they typified the economic conditions of the period: industry backward, social life crude, political conditions those of the frontier.

What a contrast to-day as one travels southward from Chicago on the New Orleans Limited! Fertile fields of corn and cotton cultivated by scientific methods; great industrial centers producing goods for a world market; a thickly settled territory peopled with as progressive and intelligent a population as can be found anywhere in the world!

To attribute these changes to the facilities introduced by the Illinois Central and other railways of the territory is to do no more than state an historical fact. The Mississippi Valley of the Twentieth Century is possible only by means of modern railway transportation.

The influence of the railway may be stated in a more specific way by a comparison of traffic statistics of the Illinois Central:

	1859.	1909.
No. tons of freight	422,433	24,876,666
No. tons moved 1 mile	51,650,364	6,042,796,872
No. of passengers	609,585	22,666,383
No. passengers moved 1 mile	88,464,814	591,733,048
Ton-miles per mile of road	73,263	1,587,371
Passenger-miles per mile of road	54,560	130,125

Where, in 1860, there was a single line southward from Chicago and East Dubuque to the comparatively unimportant city of Cairo there are now lines connecting practically every important city in the Mississippi Valley.

The vast increase in traffic has been accompanied (perhaps caused) by a marked decline in the average rates:

	1859.	1909.
Average receipts per ton-mile	2.14 cts.	0.596 cts.
Average receipts per passenger-mile	2.11 cts.	1.836 cts.

In 1851 Vice-President Neal, in an official report, suggested that the road might haul corn profitably for 4 cents per ton-

mile; in 1909 it hauled corn from Chicago to New Orleans for 4 cents per ton-mile. Coal from southern Illinois and Kentucky competes in the Chicago market with lake carried eastern coal; the grain of Illinois and Iowa competes in Liverpool with grain from England and Russia. The reductions in charges are even more significant when taken in connection with the important improvement of both freight and passenger service that makes difficult any real comparison. Perhaps the saving to the public can be emphasized in no more striking way than by the fact that had the average rates for 1859 been in effect in 1909 the railway charges would have been $94,932,145 more than they were. That the railway has performed for the public an exceedingly important service not even its most rabid opponent can deny.

The next question is: What methods has the railway pursued to secure its profits? The answer is simple: By important technical improvements in its plant and a better utilization of its capital and employees. Consider the following figures:

	1862.	1909.
Ton-miles per dollar of capital	3.4	21.4
Ton-miles per employee	288,000	1,510,000
Freight train expenses, per train-mile, ct.	.216	.118*
Freight repairs, per train-mile. ct.	.213	.118*
Total (operating and maintenance)	.466	.2198*
Maintenance of way per ton-mile, ct.	.455	.125
Interest and dividends per ton-mile	1.39	.239
Transportation expenses per ton-mile	.61	.26
Tons per freight train	81.1	355.10
Average load per freight car, tons	3.2	22.04
Ton-miles per freight car	53,819	112,111
Ton-miles per mile of road	73,263	1,587,371

*1906.

Despite the reduced cost of certain items, such as rails and machinery, it is questionable whether one dollar of capital in 1909 would go much, if any, further than fifty years earlier. On the other hand, the wages of labor—the big item in expense of operation—have increased from 50 per cent. to 200 per cent., according to the class of work. Thus, the marked decreases in expense of operating the road have been obtained only by constant exertion on the part of the management. The company has followed the good business policy of doing a greatly increased business at a smaller profit per unit—witness the reduction of profits per ton-mile from 1.39 cents to .239 cents. In addition, it has been able—by improved methods of operation—to cut in half the actual cost of moving the traffic. With constant demands for improved service, with a steady increase in the rate of wages, with greater demands on the part of the public, the marked reductions in cost of operation, and with them reduced charges to the public, are a tribute to the efficiency of management.

That the railway has committed many sins in the form of secret rebates, unjust discrimination and control of public servants is unfortunate. No one condones such offences. Nevertheless, they are incidents, unfortunate, it is true, but incidents in the development of transportation. They are the outcome of an almost universal system of business practice for which the people, and the people alone, are responsible. Is a railway buying a legislature to secure a necessary franchise which the political machine will not give honestly a greater offender than the farmers who force through legislation giving to a partizan and political railway commission power to arbitrarily reduce rates in their own interest? The railways bribe the legislatures, but who elect men that will be bribed? The railways give illegal rebates, but who elect the judges and executives who should enforce the law? Before the general public judge too harshly the past sins of the railways it might be well for each individual to scrutinize most carefully the honesty of his own gains. "Let him that is without fault cast the first stone."

The third basis of comparison is the profit made by comparable industries. Like must be compared with like. The shareholders of the Illinois Central for practically sixty years have assumed the risk of management of one of the largest railway enterprises in the world. They have borrowed vast sums of money, the obligations of which must be met irrespective of business conditions. They have been responsible to the public for an economical and efficient system of transportation for the millions of people dependent upon the railway. These are not imaginary risks and responsibilities. In 1873-78 the shareholders invested over $5,000,000 in various southern lines, and for a while this threatened to be a total loss. From 1867 to 1887 the company operated the Iowa lines at a total loss of over a million dollars. A number of bankrupt roads have been purchased and the danger of heavy loss incurred. Since 1867 the company has leased thousands of miles of road and has guaranteed annually millions of dollars of fixed charges. That these undertakings have proven successful is due to the splendid financial credit of the corporation and to its sagacious management. It is an axiom of business, as well as of economic theory, that he who assumes the risks of an enterprise should also receive the profits. The shareholders of the Illinois Central have assumed great responsibility and many risks; it is a clear injustice to measure their profits by the return on perfectly secured first mortgage bonds or on first-class farm liens.

Moreover, the ability of the management must be taken into account. The talents of men are not all alike. Should the profits of a Marshall Field or a John Wanamaker be compared with those of a small merchant unable to rise above his petty surroundings? The Illinois Central has been managed by men of exceptional ability, and the results of their labor should be compared with those of their business equals, not their business inferiors. While the road has not been managed by such brilliant geniuses as Vanderbilt, Gould, Huntington and Harriman, it has had executives of first-class rank. Among the men prominent in the affairs of the road have been lawyers, such as Lincoln, Fentress, Ayes, Dickinson; engineers, such as Robert Mason, Geo. B. McClellan, J F. Wallace; financiers, such as Robert Schuyler, Geo. Bliss, J. Pierpont Morgan, E. H. Harriman, Levi P. Morton; executives, such as W. R. Arthur, W. K. Ackerman, W. H. Osborn, J. C. Clarke, E. T. Jefferey, Stuyvesant Fish and J. T. Harahan. Unlike many other great undertakings, the road has been operated solely in the interests of its owners and of the public, and if these men of exceptional ability have not all made for themselves distinguished fortunes they have carefully developed the interests entrusted to their trusteeship. In ability of management the Illinois Central compares favorably with other great western enterprises carried on by men such as Gustavus Swift, Philip Armour, Marshall Field, McCormick, Pullman, etc. But where these men started with hardly a cent to their names, the Illinois Central started with an initial investment of nearly thirty millions at a time when capital in the West was very scarce. It is no more than fair to compare the Swift, Armour, Field, McCormick Pullman fortunes with the profits of the owners of the railway.

It is by these standards, therefore, that the profits of the Illinois Central must be judged. It has rendered the public service of tremendous importance; by a management of a high standard of ability it has greatly cheapened the cost of transportation and extended widely the means of communication; as a reward its owners have received good returns on the cash they have invested.

It would be interesting to compare the profits of the railway with other concrete investments, but that is perhaps impossible. In the period under consideration tax free farm mortgages have paid from 5 per cent. to 15 per cent. interest. The Illinois Central has borrowed money at approximately the following rates: 7 per cent. to 1868; 6 per cent., 1868-1880; 5 per cent., 1880-1890; 4 per cent., 1890-1909, or an average of somewhere around 5 per cent. As compared with these returns the railway, viewed as a whole, has earned from its railway business from 1.55 per cent. to 8.45 per cent., an average of 5.69 per cent. The amount actually paid in dividends and interest would run something under this percentage. In 1909, a year under the average, the net amount

paid on the entire investment was just .49 per cent. higher than the interest paid on the cash value of the funded debt, viz., 4.79 per cent. and 4.30 per cent., respectively.

The returns to the shareholders have been much more liberal. The 52-year average has been 9.48 per cent. earned and 7.6 per cent. paid on the cash actually invested; 8.38 per cent. earned and 6.61 per cent. paid on cash investment plus accumulated surplus. In addition, there is an appreciation of value amounting to $20 to $30 per share (excluding influence of land grant). During the same period parts of the land grant originally sold at from $8 to $15 per acre have increased in value to $100 to $225 per acre. But such comparisons are erroneous because they cannot take into account long periods of small gains and even of losses.

It is not the purpose of the writer to draw any conclusions either for or against the corporation. Each reader must be his own judge of the rewards obtained by the Illinois Central management. In drawing those conclusions, however, he should be fair to the corporation as well as to the public. Likewise, it should be remembered that the company has received many favors from the public; it is a public-service corporation; the risks of management are less than in industrial concerns, and the owners are largely trustees to the public.

In conclusion it may be asked how far the returns of the Illinois Central are applicable to the railways of the country as a whole. In the first place, the writer believes that a similar inquiry regarding railways such as the Chicago & North Western, the Chicago, Milwaukee & St. Paul, the Chicago, Rock Island & Pacific, the Chicago, Burlington & Quincy, the Great Northern, the old Chicago & Alton, the Pennsylvania, the New York, New Haven & Hartford, the Louisville & Nashville, and other roads of that type, would tell pretty nearly the same story. The rewards of capital and business ability have been high during the past half century and the railways have shared in the distribution.

In the second place, a careful distinction should be made between the profits of the railway as a whole, and that of either the shareholders or of a few manipulators on the inside. The majority of readers will admit, I believe, that the return on the total investment, 5.69 per cent., is not excessive considering the risks and dangers. The shareholders of the railway have secured considerably larger returns because, first, they assumed all the risk and borrowed money at less than 5.6 per cent. from conservative investors; second, they reinvested a large part of the surplus, thereby guaranteeing the permanence of a fair dividend rate. Had a more speculative management been in control the total earnings of the road would not have been any greater (assuming corresponding ability of management) but the division between stock and bond holders might have been radically different. For instance, had the stockholders invested, say, a half or a third the capital they did they would have earned, at times, perhaps 20 per cent. to 30 per cent. on the cash investment; at other periods they could not have met interest charges and might have lost their original investment. Speculative reorganizations might have followed by which a few financiers on the inside would have made large profits at the expense of the unfortunate stockholders.

While the Central has a considerable monopoly of its territory it is also subject to fierce competition; its important business, viz., from Chicago to St. Paul and Omaha, to St. Louis, to Memphis, to Birmingham, to Louisville and to New Orleans is strongly competitive. As a result its rates are made very largely, if not entirely, independent of the amount or character of its capitalization. On the Chicago-St. Louis business the undercapitalized Illinois Central line shares the same rate with the overcapitalized Alton and Wabash. Had the Illinois Central line from Otto to East St. Louis cost the Central $10,000,000 or $15,000,000 instead of $5,589,430.98 the gross and net receipts could be no larger. If the total cash invested in either the Alton or the Wabash could be obtained it is doubtful whether the average return would be radically different from that on the Central; except, perhaps, for better management on the part of the Central or the Alton.

In 1876 the Illinois Central had some $5,000,000 tied up in the southern lines which threatened to be a total loss. This caused a bad slump in the stock, so that full paid shares dropped to 40. W. H. Osborn, practically in charge of the road, could have so manipulated affairs that a large number of the shareholders would have sold at this low price. There was an opportunity to make millions of dollars. Instead, the management advised the shareholders not to sell, and eventually turned the threatened disaster into the most profitable and brilliant extension of the railway. They made millions for their shareholders, but they lost an opportunity to make fortunes for themselves.

As James J. Hill has repeatedly emphasized, the present is a time when the transportation facilities of the nation need billions of additional capital. It is time that the public awake to the facts of railway history. The popular writer, the politician and the man with an axe to grind have exposed the skeleton in the railway closet, and in exposing the methods by which some great fortunes have been made have intentionally or unintentionally led the public to believe that the skeleton inhabitated the whole house. It is well that the story of fraud, of rebates, of mismanagement of property and betrayal of trust be told; it is equally important that the public realize the value of the services rendered by the railways of the country.

If secret rebates exist, enforce the law against shipper and carrier. Legislatures and the judiciary are unduly influenced? Remove the conditions which make such things possible. Stockholders and investors are robbed by those to whom they entrusted their property? Turn the searchlight of publicity on every corner of the closet and let the accumulation of filth and dirt be impossible. But also let the splendid record of many American railways be known for what it is worth. Let men like Stuyvesant Fish, W. C. Brown, A. J. Cassatt and the thousands of others who have placed the interests of their shareholders above their personal profits have credit for what they have done.

The writer leaves to the reader judgment as to the justness of the profits received by the shareholders of a railway such as the Illinois Central. Seven and eight per cent. dividends may be too small; they may be too large. Be that as it may, let the comparison be made with what the railways have done and with what the profits made in other lines of industry. Excessive profits to those who invest their money in safe undertakings is one thing; reasonable returns to those who have borne the heat and toil of past economic developments is quite another matter. A poorly paid laborer gives poor results; a well paid laborer usually gives good results. In all the problems of railway rates, regulation of public service corporations, etc., the public must still answer the old question: Is not the laborer worthy of his hire?

ELECTRIC LINES IN TURKEY.

Reouf Bey, acting consul general of Turkey at New York, has announced that the ministry of public works in Constantinople has opened bids for building a system of electric trolley lines in and around Constantinople. The successful bidders are offered the franchises of five lines decided on by the government, and such additional lines as the bidders may propose and the government finds desirable. The time for the submission of the projects is six months. Specifications can be had from the Turkish consulate at New York. The five lines proposed by the government are: From Chichli to Kilios on the Black Sea, along the European shore of the Bosphorus to Buyukdere and traversing the Foret de Belgrade; from Scutari to Kadikeuy and Moda; from Yedikoule to Chichli and the Sweet-Waters-of-Europe; from Scutari to Alemdagh; from Scutari to Beicos and the Mountain of Geant.

RAILWAY BUSINESS MAIL.*

OFFICE OF THE .....

NEW YORK, ...

MEMORANDA FOR THE GUIDANCE AND INFORMATION OF EMPLOYEES OF THE NORTH & SOUTH RAILROAD CO. IN THE HANDLING OF RAILROAD BUSINESS MAIL.

MATTER WHICH WILL BE CARRIED AS RAILROAD BUSINESS MAIL.

LETTER MAIL ON NORTH & SOUTH R. R. CO.
MAY BE EITHER SEALED OR UNSEALED.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*

1. Letters and other communications, relating to the business of the North and South Railroad Company, exchanged between officers, agents and employees of the Company.

LETTER MAIL TO IMMEDIATELY CONNECTING ROADS.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*

2. Letters and other communications relating to the business of this Company and immediately connecting railroad and transportation companies, exchanged between such companies, may be carried to and from authorized junction points.

PRINTED AND OTHER MATTER, ON NORTH & SOUTH R. R. CO., AND TO OR FROM IMMEDIATELY CONNECTING ROADS.
MAY BE EITHER SEALED OR UNSEALED.

Relates to
Printed matter.
Advertising matter.
Returned baggage checks.
Freight tariffs.
Passenger rate sheets.
Time tables.
Claim papers.
Car tags.
Blue prints.
Waybills, copies, abstracts and corrections of same.
Tracers.
Car reports.
And any other matter relating to business in which the North & South Railroad Company participates.

3. All classes of printed and other matter, in which this Company is interested, destined to points on North & South Railroad; also to or from immediately connecting roads, may be carried on the North & South Railroad to and from authorized junction points.

Packages destined to connecting roads or beyond are limited in weight to ten (10) pounds.

Waybills should be enclosed in special envelopes bearing imprint "Waybills," and plainly marked via route of the shipment.

If contents cannot be inspected without damaging wrapper, package must bear label reading "Printed Matter."

PRINTED AND OTHER MATTER TO OR FROM ROADS BEYOND IMMEDIATE CONNECTIONS.
UNSEALED ONLY.

Relates to
Printed matter.
Advertising matter.
Returned baggage checks.
Freight tariffs.
Passenger rate sheets.
Time tables.
Claim papers
Car tags.
Blue prints.
And any other matter of like character relating to through business in which the North & South Railroad Company participates, not letters, and not classed by Post Office Department as letter mail.

4. All classes of printed matter and any other matter of like character unsealed, in which this Company is interested, which are not letters and not classed by the Post Office Department as letter mail, exchanged to or from roads beyond immediate connections, may be carried on the North & South Railroad to or from authorized junction points.

When it is desired that a letter of transmittal should accompany such packages addressed to or from roads beyond immediate connections, such letter must be enclosed in sealed government stamped envelope, the stamp being embossed on the envelope. The date of the letter must be written or stamped on the face of the envelope. The opening of the envelope cancels the stamp. The ordinary postage stamp applied by mucilage cannot legally be used. The government stamped envelope of a sufficient denomination to cover its contents must be attached to the outside of the package.

Packages from or destined beyond immediate connections are limited in weight to ten (10) pounds.

Packages must be so wrapped that they are subject to inspection and should be marked "Printed Matter," or "Claim Papers," etc.

MAIL TO OR FROM INDIVIDUALS OR COMPANIES OTHER THAN RAILROADS.
MAY BE EITHER SEALED OR UNSEALED.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*
Printed matter, etc., covered by Rule 3.

5. Letters and other communications, relating to business of this Company, exchanged between this Company and

Express companies,
Telegraph companies,
Sleeping and parlor car companies,
Passenger or baggage transfer companies,
News companies,
Co-operative freight lines,
Operating associations,
Traffic associations,
Demurrage bureaus,
And such concerns and individuals that do business with (or over the lines of) this Company,

provided such letters and communications are handled only by agents and employees of the sender and those addressed.

Relates to
All mail matter.

6. All matter specified in these rules that may be carried as railroad business mail should be clearly addressed, and if destined to points beyond this road must bear route and junction points, and in addition to other marks be plainly marked with initials "R. R. B." and the name of the forwarding company.

MATTER WHICH WILL **NOT** BE CARRIED AS RAILROAD BUSINESS MAIL.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*
Printed matter, etc., covered by Rule 3.

7. Letters and other communications of any character not relating to business of the North & South Railroad Company.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*

8. Letters and other communications to and from foreign roads which have no immediate connection with the North & South Railroad Company.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*

9. Letters and other communications between connecting roads and their local agents situated along the lines of this Company.

Relates to
Letters and communications *entirely written.*
Letters and communications *partially written* and *partially printed.*
Printed matter, etc., covered by Rule 3.

10. Letters and other communications, relating to business of this Company, exchanged between this Company and

Express companies,
Telegraph companies,
Sleeping and parlor car companies,
Passenger or baggage transfer companies,
News companies,
Co-operative freight lines,
Operating associations,
Traffic associations,
Demurrage bureaus,
And such concerns and individuals that do business with (or over the lines of) this Company,

unless such letters and communications are handled *only* by agents and employees of the sender and those addressed.

Relates to
Letters.

11. In general no company or carrier nor any officer or employee thereof may carry letters in the railroad business mail which are neither written by an officer or employee of the *Company* nor addressed to it.

Relates to
All mail matter.

12. No packages will be handled *to or from connecting roads* exceeding ten pounds in weight.

Relates to
All mail matter.

13. No matter will be accepted unless it bears the name of the forwarding company and marks indicating that its content is railroad business mail.

*Code of Rules reported by a Committee of the Association of Transportation and Car Accounting Officers; suitable for any railway, but worded as though prepared for the "North & South Railroad."

GENERAL.

Relates to All mail matter.

14. In case of doubt always use United States Mail and immediately submit question for decision to *_____

* Designate officer.

TRANSPORTATION AND CAR ACCOUNTING OFFICERS.

The thirteenth meeting of the Association of Transportation and Car Accounting Officers was held at the Antlers' Hotel, Colorado Springs, Colo., June 21 and 22, representatives of over one hundred railways being present.

The delegates and their families were welcomed by the mayor of Colorado Springs, following which A. D. Parker, vice-president of the Colorado & Southern, gave an interesting talk.

The report of the executive committee indicates a membership of the association of 218 railways, operating 232,556 miles and having in service 2,323,107 cars. An amendment to the constitution was adopted authorizing the appointment by the executive committee of an assistant secretary. An amendment to the by-laws was also adopted changing the name of the committee on car service and per diem to that of committee on car service. It was decided to hold the next meeting of the association at Chicago December 13 and 14, 1910, and the summer meeting next year at Cape May City, N. J., June 20 and 21.

The opinion of the committee on car service that a uniform embargo notice is impracticable was concurred in. The opinion of the committee that no change is necessary in Rule 7 of the per diem rules was concurred in, as was the opinion that no change is necessary in the definition of the term "Switching Service" in the per diem rules. The committee was instructed to prepare for submission at a later meeting amendments to the per diem rules to cover the payment of per diem on all railway cars every day that the same are on foreign lines, including new cars en route from builder to owner, with provision for reclaim if mutually agreed upon.

The report of the Committee on Office Methods and Accounting, recommending the practice of not including the deliveries of more than one date on a junction on report, was adopted. The association adopted the committee's recommendation with regard to showing reporting marks at the head of each column of the per diem report and the entering thereon of each car number in full for every car shown; it being the consensus of opinion that abbreviations in the number or initial will result in errors. The recommendation of the committee with reference to the receiving road retaining the best carbon copies of interchange reports, the printing of interchange reports on a bond paper weighing 16 pounds to the ream of 500 sheets 17 in. x 28 in., and the necessity for checking of information in interchange reports by proper representative of the receiving road before certification was adopted as the recommended practice of the association.

The association recommends the practice of calling attention to apparent over-allowances in per diem reports received and adopted form O.M. 24 (k) for that purpose. Under Subject No. O.M. 30 the association concurred in the expression of the committee in Resolution No. O.M. 30, which provides a method for handling per diem claims, designates the road which shall furnish proof in case of dispute as to date of interchange, but does not determine the character of the proof, inasmuch as the character of the proof must, under the per diem rules, be determined by the roads at interest, in accordance with local conditions.

The circular prepared by the Committee on Handling Railroad Business Mail, covering matter which may and may not be carried as railway business mail, was adopted for submission to the American Railway Association. This appears in another column of the *Railway Age Gazette*.

Under Subject No. C.T. 4 of report of the Committee on Conducting Freight Transportation, the association was favored with a paper containing the remarks of E. D. Levy, superintendent of transportation, St. Louis & San Francisco, before the General Managers' Association of the Southeast, at Atlanta, Ga., March 10, 1910, in connection with the handling of over, short and damage reports by the transportation department. The committee was instructed to investigate and report upon the possibility of placing hasps on freight car doors near a more convenient reaching distance of the men who are required to inspect and record seals from the ground. That portion of the report of the committee under Subject No. C.F.T. 5, which provided for the annual re-weighing and re-stenciling of cars of railway ownership was returned to the committee for further consideration. In this connection, however, the association recommended that the American Railway Association be requested to consider the advisability of recommending to the Master Car Builders' Association a change in the rate charged for re-weighing and re-stenciling foreign cars, to an amount not less than one dollar a car. Under Subject No. C.F.T. 7 the committee advised that the rules of the Railroad Refrigerator Service Association in connection with the handling of perishable freight are now in the hands of a sub-committee for the purpose of providing adequate transportation rules, the same to be embodied in the rules of the Railroad Refrigerator Association.

The report of the Committee on Conducting Passenger Transportation under Subject No. C.P.T. 3, which recommended the modification of Rule 7 of the per diem rules to provide for joint service and per diem rates on passenger equipment according to capacity, was returned to the committee for further consideration. At the request of the committee Item d of Subject C.P.T. 3, relating to uniform mileage rates on passenger equipment cars hauled empty for delivery to borrowing road, was returned to it.

The Committee on Joint Interchange and Inspection Bureaus reported that at its instance the General Superintendents' Association of Chicago is now prepared to experiment with joint interchange and inspection at the Union Stock Yards district of Chicago for a period of three months. The results of this experiment will be reported to the association at its next meeting. During the consideration of this report the association was favored with an interesting description of the joint inspection and interchange bureau at Pueblo by the manager, Mr. Roberts, also with a detailed account, by J. A. Wagner, of the workings of the Iowa Transfer at Des Moines.

The election of officers and members of committees resulted as follows: Officers for the year 1910-1911: president, M. B. Casey (D., L. & W.); first vice-president, G. W. Taylor (Southern); second vice-president, W. T. Wolff; secretary, G. P. Conard; treasurer, F. M. Luce. Members of the executive committee for the term expiring 1913, E. D. Levy (St. L. & S. F.); T. S. Bell (Pennsylvania). Members of the Committee on Car Service and Per Diem for the term expiring 1913, Hocking Valley Railway and Wabash Railroad. Members of the Committee on Office Methods and Accounting for the term expiring 1913, Chicago, Milwaukee & St. Paul Ry. and Western Maryland R. R. Members of the Committee on Nominations, term expiring 1911, C. C. Riley (K. C. S.), M. J. C. Wrenne (N., C. & St. L.) and Fred Clark (C., B. & Q.).

RAILWAY TIES FOR CHINA.

The call for bids for railway ties was advertised in the Shanghai papers in November and December last and called for 150,000 wooden sleepers, 1,600 crossing timbers and 5,000 bridge ties. Two American firms submitted bids for Oregon pine, but, although their quotations were lower than jarrah wood, they failed to secure the award. It is thought that the reason therefor was the inferior quality of wood supplied under a previous contract, the creosoting process proving quite unsatisfactory. The Oregon timbers supplied at the time were evidently merely coated with creosote, the preservative not being injected under pressure as it should have been.

Shop Section.

BECAUSE of the large number of shop kinks submitted in the competition which closed on June 15, the judges have been unable to come to a decision as to the prize winners in time for publication in this issue. The list this time contains ten competitors, ranging from master mechanic to apprentice. Three of the present competitors have each entered in two previous competitions, showing that their interest did not cease with one trial. Geographically this last contest represents the states of New Hampshire, New York, Maryland, Virginia, Tennessee, Georgia, Indiana, Iowa, New Mexico and California. Nine railways are included, both of the far western competitors being employed on the Santa Fe. The result of the competition will be announced August 5.

THE individual motor drive, as applied to machine tools, and the high speed tool steels have revolutionized machine shop practice and machine tool design within the past ten years. Shop managers and engineers were surprised to find how little they knew of the individual capacity of the tools in their shops when they were confronted with the problem of applying individual motor drives and were forced to analyze the work being done by each tool and to study its possibilities. In spite of the wonderful strides which have been made in machine tool operation there is still much to be gained, as a study of Mr. Robbins' article on another page will show. "The fact that few tools are in operation more than 50 to 60 per cent. of the time and that the load factor may be as low as from 10 to 40 per cent." indicates that there is room for considerable improvement in getting the work in and out of the machine, in adjusting it, in changing and adjusting the cutting tools, in getting the work to the machine and in getting as much work as possible out of the machine while it is in operation. The fact that the surcharge or burden on the tool per hour is usually considerably higher than the wage per hour of the operator does not seem to be generally understood, although progressive shop managers and betterment engineers have been directing attention to the fact for several years.

THE story is told, and is vouched for as being true, of a requisition that was received from a small shop on a western railway for an additional air compressor. The necessity for this could not be understood at headquarters, and the superintendent of motive power sent a member of his staff to investigate. The shop was in a district subject to extremely high temperatures, and it was found that the master mechanic, in order to rest comfortably, had installed three or four nozzles in the bedroom of his bungalow connected to the compressed air system. The turning of a valve when he retired to his room would insure a cool and comfortable night's rest. It is needless to say the air compressor was not furnished. The installation of a small electric fan gave him an equal amount of comfort at very much less expense.

This is hardly more extravagant than the practice at a number of terminals or important points of furnishing compressed air from one power plant for the repair shops, car repair yards, roundhouses and classification yards. This not only requires a large amount of extra piping, but the air pressure at the outlying points varies greatly and is not at all satisfactory. It is far better to install two or three electrically driven compressors at the more important centers of distribution. Electrical energy may be transmitted to these points from the central power plant far more efficiently than compressed air. The reduction in the length of piping reduces the cost of maintenance, especially in cold weather when the moisture gathers and freezes in the pipe and has to be thawed out. The loss through leakage is also reduced in direct proportion to the reduction in the length of the piping. The electrically operated compressor requires little attention and is said to give very satisfactory results.

THE fact that a high-speed tool steel was practically destroyed at a temperature within 50 degrees of the best temperature for tempering it, was brought out in a paper presented before the Western Society of Engineers by C. P. Berg, of the Link Belt Company. An abstract of this paper appears on another page of this number. This is a most important point, for in tempering tools it is common to employ a man who judges the temperature by sight, according to well-known scales to be found in the standard mechanical engineers' pocket books and textbooks on iron and steel. According to the temperature table of M. Pouillet, deep orange heat indicates a temperature of 2021 deg. F.; a clear orange heat indicates a temperature of 2192 deg. F.; a white heat indicates a temperature of 2372 deg. F., and a bright white heat indicates a temperature of 2552 deg. F. There is a difference of 172 degrees between a deep orange and a clear orange heat. There is a difference of 180 degrees between a white heat and a bright white heat, yet the ability of men to distinguish between these slight shades in color depends wholly upon the eye of the individual. When a tool steel is found to be most efficient and to have the longest life when quenched at a temperature of 2350 degs. and is burned and practically destroyed at a temperature of 2400 degs, it must be realized that some more efficient method of determining heat in tempering tools must be adopted, and a good pyrometer should be used. With the remarkably efficient apparatus now on the market for obtaining the right degree of heat and for ascertaining when this degree has been reached, it is unlikely that the use of the human pyrometer will be continued long in shops where many tools have to be tempered.

WHILE the convention of the International Railway General Foremen's Association, held in Cincinnati early in May, was a successful one, it would have been much more so had a better selection been made of the subjects for discussion. That the executive committee realized this is indicated by the subjects which have been chosen for the 1911 convention. In the first place the number of topics to be reported on has been reduced to four. These are thoroughly practical and are such that the foremen can discuss then to advantage and should receive much benefit from the discussion. A most noticeable feature of the recent convention was that the moment the discussion touched on the problems of shop organization or efficiency the members almost immediately began to show a greater interest in it. Men who were not accustomed to speaking in public found little difficulty in expressing themselves and in making themselves understood at such times. Why? Because each one had tried in his own way to increase the efficiency or output of his shop and, realizing the complexity and immensity of the problem, was watching keenly for any suggestions which might add to his success in getting still better results. It is from such discussions as this that the men gain inspiration and go back to their work with renewed zeal and accomplish surprising results. A few years ago a general foreman attended one of these conventions for the first time. He felt pretty well satisfied with the results he was obtaining, but after listening to and taking part in the discussion and talking things over on the side with some of his newly found friends, he came to the conclusion that he was a novice at the game. Probably he underestimated his ability, for he had gathered a good and loyal organization about him. He began to put some of his new ideas into effect and made one or two trips to other shops whose good practice in certain respects had been brought to his attention at the convention. To-day he is regarded as more

or less of an authority on shop efficiency. The man from whom he claims to have received his first and much of his inspiration is also enthusiastic about the help he has received from attendance at the conventions. With this feeling on the part of most of those who have been attending the conventions and three such subjects on next year's program as "How Can Shop Foremen Best Promote Shop Efficiency?" "Methods of Shop Organization" and "Shop Kinks" the success of the General Foremen's Association is assured and its field of usefulness will be greatly extended, especially if the intention is carried out of having the next convention held at a central point which may easily be reached by a large proportion of the railway shop foremen.

THE DURABILITY OF TOOL STEEL.

THERE are probably very few men that have not experienced a feeling of surprise when they saw, for the first time, a piece of high speed steel cutting a heavy chip at a rapid rate, while the tool itself was held continuously at a red heat. We have associated this temperature with softness for so long that it is impossible to disabuse ourselves of the idea at once. The case is analogous to that of the penetration of the X-rays. A brick is no more solid than a piece of glass, but because we can see through the glass, we have difficulty in picturing to ourselves the penetration of a visually opaque brick by a ray of light.

It is evident, however, in the light of recent research that we will be obliged to revise our preconceived ideas as to the effect of heat on the cutting qualities of tool steel. The matter was treated quite exhaustively in a recent paper read before the Iron and Steel Institute by Edward G. Herbert.

The experiments upon which the conclusions of the paper were based were made with a machine constructed for the especial purpose of determining the durability of various tool steels. In this work one element was fixed that has not, heretofore, been treated with scientific accuracy. This is the condition of bluntness to which the tool is worn. The other features, such as the shape of the cutting tool, the thickness and width of the chip, and the speed of the tool were all determined, and then the amount that could allowably be worn away from the point of the tool was taken as a measure of its bluntness; the apparatus was so designed that this could be accurately measured while the tool was at work. With these conditions fixed its durability could be determined. That is to say, its durability could be denoted by the number of minutes that it would continue cutting under the standard conditions before reaching this predetermined condition of bluntness. And here comes in one interesting point as to whether the relative durability of various steels is independent of the conditions of cutting. As, for example, whether a steel that shows a greater durability than another in cutting steel will show the same superiority when cutting brass. There is some reason to believe that it may not.

The results of the investigations detailed in the paper go far to substantiate the soundness of the heat theory of tool steel durability. That is to say, the durability of a steel is dependent upon the temperature at which it is operated, and though many of the phenomena have escaped notice in the shop, they are found to check with practical experience.

It has been noticed that, at low speeds, carbon steel is more durable than the high speed steels, but that at higher speeds the carbon steel is less durable. So the fact that a high-speed steel will not keep its edge so well as a carbon steel under a light, finishing cut has long been familiar to engineers; but the fact that the durability of a high speed steel, working under a light cut, can be greatly increased by running at a high speed, and that under these conditions it will keep its sharp edge better than a carbon steel tool is not generally known. The most curious thing in the whole matter is that the durability of all steels, without exception, is very low at low speeds under light cuts, and that the durability of the cutting edge increases as the speed is raised. In this connection the durability is measured, not by the time that it will continue cutting without becoming blunt, but by the amount of metal that it will cut away.

The points to be settled were the cause of the durability of the cutting edge of a given steel at different speeds and the physical changes that are produced. "If it had been found that an increased cutting speed involved a simple decrease in the durability of the cutting edge, it would have been natural to answer the first point raised by saying that we were dealing merely with the rubbing of metal against metal; that this rubbing was more severe at the higher speeds and, therefore, caused the more rapid wear. But it has been found that an increase in the cutting speed is actually accompanied by an increase in the durability of the tool, that this durability attains a maximum at a certain speed, which is different for steels of different chemical composition, and that the durability then declines as the speed is further increased, so that it becomes evident that this explanation is insufficient. The durability of the cutting edge cannot depend simply on the rubbing of metal against metal, but it may depend on that which results from the rubbing, namely, the evolution of heat and the consequent rise in temperature of the cutting edge, a rise which naturally becomes greater as the speed increases.

"Assuming this to be the case, we find that the durability or wear-resisting properties of all tool-steels is relatively low at normal atmospheric temperatures, that it increases as the temperature rises, attains a maximum at a certain temperature, dependent upon the composition of the steel, and declines as the temperature is further raised."

If this theory is correct it should be possible to vary the durability of a tool running at a constant speed by simply varying the temperature and this can best be done by varying the depth of the cut. Experiments were made along these lines and the results were found to check. That is to say, at constant speeds and varying depth of cut, the durability increased to a maximum and it did exactly the same thing with varying speeds and constant depth of cut.

The work was then continued by determining the durability under conditions of varying speeds and constant cut and the maximum ascertained when the work was flooded with cold water. Then the work was flooded with water at a temperature of 149 deg. F., when it was found that the maximum durability was attained at a lower cutting speed. That is to say, at a point where less heat was needed from the rubbing action to raise the tool to the critical temperature.

The question was then attacked from a purely theoretical standpoint wherein it was assumed that the action of a tool in cutting steel was exactly analogous to that of a jet of water impinging on a fixed object. That is to say, the tool was in the act of cutting through a stream of metal, and that the same laws would govern in the two cases. This law is that the rate at which energy is dissipated in the form of heat is proportional to the cube of the velocity of the jet. According to this law, then, the heat at any point on the cutting surface of the tool is proportional to the thickness of the chip, multiplied by its area with the result multiplied by the cube of the cutting speed. In order to check the accuracy of this assumption the data obtained by F. W. Taylor and described by him in a paper before the American Society of Mechanical Engineers in 1906 was taken and plotted. Curves were then plotted based on the assumption and the two were found to coincide so closely as to show very clearly that the hypothesis is a correct one in its essential features.

A further experiment tended to corroborate the heat theory. In the early work the material and tool had been flooded with water, which must have had some cooling effect on the tool though the point was embedded in the metal and was inaccessible to the water itself. It was found that, on running the tool dry, that the maximum durability was attained at a lower speed and that when the speed increased beyond that critical point the

durability dropped away more rapidly than it did with the water cooling. This is what was to be expected since the rate of heating would be more rapid when running dry than when flooded.

Now, turning to the workshop side, we find that there is a mass of corroborative evidence, pointing to the probable truth of the heat theory. For instance, it is well known that a tool usually stands up to its work better if it starts warm, that is to say, if it is put in the fire for a moment before being used, and that frequently the durability of the tool is increased by increasing the cutting speed.

Another curious thing brought out by these investigations is that there are frequently two points of maximum durability. For example, the durability of a steel may increase up to a speed of 40 ft. per minute and then fall off until at 60 ft. it is very low, beyond which it will rise again and be more durable at 80 ft. than it was at 40 ft. This phenomenon is exceedingly common and is not confined to any one class of steel. It is, of course, natural that this should not have been observed in the shop, because a workman, on finding that his tool was wearing away too rapidly, would not be apt to increase the cutting speed and would thus fail to develop this secondary point of durability. The other difficulty in getting at this is the fact that before the temperature can reach the high degree corresponding to the second point of maximum durability it must pass through the one corresponding to the lesser degree of durability lying between the two maxima. Still we have some evidence that this is what does take place. A tool after being set to work "apparently fails, that is it becomes blunted to some extent, but if it is allowed to continue cutting it 'builds up' according to a workshop expression and recovers its durability and may continue cutting for some time without a further loss of sharpness."

The matter has not yet been sifted to a finality. There are too many elements entering into the durability of a tool to permit of that for some time. The chemical composition, the rate of cooling, the degree of temper, the method of cooling, all have an influence that is subtle but appreciable. Enough has been done to show that the contradictory results obtained with various tempering compounds are quite reasonable when viewed in the light of this new theory. Why there should be two points of maximum durability is difficult to understand and much work will have to be done before the phenomenon will be explained. But this much does seem to have been shown with a fair degree of positiveness, that all tool steels increase in durability as their temperature is raised above that of the atmosphere, and that there is some critical temperature, varying with each and every class and composition of steel, at which its maximum durability will be found and at which it will do its best work.

Letters to the Editor.

AIR BRAKE HOSE INSPECTION.

Sidney, N. Y., June 16, 1910.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

Covering economical practice, may I suggest that in fitting air hose the angle of the coupling be arranged so that the label is always on top when the hose is coupled. This allows inspectors to readily examine the label and determine the age of the hose, and saves time in inspection.

May I also suggest that a shape or form of label could be adopted as standard by the M. C. B. Association, such as a broad arrow or a crescent, to be placed in service after an agreed date. This could be copyrighted, hence all inspectors could at a glance determine the age of the hose. This would avoid delay in inspection, and as railways sell transportation, anything which will speed that should be of benefit.

DOPE BUCKET.

HOW THE FOREMAN CAN PROMOTE SHOP EFFICIENCY.*

BY C. L. ALDEN.

Foreman Heavy Freight Car Repairs, New York Central & Hudson River, West Albany, N. Y.

The promotion of efficiency should be the constant aim and ambition of the foreman, first, last and all the time. It is generally admitted that now, as at no time in the past, the foreman is privileged to use his ideas, initiative and plans and, as is right, is held strictly accountable for results. His aim should be to encourage thrift, industry, incentive and invention, to create harmony and to prevent as far as possible discord, strife and agitation. He should be a man of known temperate, steady habits, possessing a clear brain, cool, calm judgment and an education of sufficient caliber to which added experience will make a good, all-around practical employee. He should exercise his authority with justice, acting promptly (but not hastily) without equivocation, honorably and unselfishly, with the idea in mind that he is dealing with his fellow men, treating them as men, equals, who, for the time being, are so situated that he is perhaps the more fortunate in a monetary sense, and that to-morrow, figuratively speaking, the relationship may be reversed. Do not think I advocate supineness, taking the course of least resistance (although it really is) or that I lack a proper appreciation of my employer's end of affairs, for that is the end sought above all else, and that is the surest and safest course to attain my own advancement. I have proven this course to be to our mutual interest, and do not say it will meet every case or location, but believe it will.

The foreman should be in a position at every pay day period to know just what each employee is earning. Especially is this true where labor is done on a piecework basis. I am now writing more especially of repairs to freight cars, both foreign and local, and of all classes and degrees of defects. He should learn the standards for each car and class of car, together with changes, omissions, additions, etc.; also be able to learn early if the car is in need of painting; if it is able to run for another year or more without it, it is so much gained.

He should be able to determine promptly whether repairs are made properly; that through material men a proper supply of necessary material is in stock at all times, thus avoiding unnecessary delays; and that delivery is made to cars or supply stations promptly in order that the delays be reduced to a minimum. Also that metal parts for straightening, welding or alteration are sent to the blacksmith shop, repaired and returned promptly. He should so plan his work, and work his plans, that when he causes a job to be marked "rush" when sent to the blacksmith or machine shop, there will be no doubt in the mind of anyone handling it that he means just that. Too many men fall into the error of marking jobs rush when there is absolutely no need of it. The job lies a long time before being taken away and the machinist or blacksmith quite justly is of the opinion that he really wasn't in a rush for it and the word loses its effectiveness, and in a short time the foreman must accompany the job or be disappointed.

Your bright, active foreman desires above all things to release cars promptly, especially foreign ones, or those on which a date of release has been given. He must see that a proper and sufficient supply of company-furnished tools are in stock to meet all emergencies, as well as to see that each employee supplies himself with his share of tools to do his work in a suitable manner. The tools he is furnished with should be recorded on a card showing just what was issued, the name of the workman, date, etc., and an accounting should

*This is one of the articles that was submitted in the competition which closed April 15. Other papers on the same subject were published in the issues of May 6 and June 3, 1910.

be made whenever the employee leaves, is transferred or discharged. This is an effective way of reducing "lost" tools to a minimum.

The foreman should not hesitate to teach his inspectors any details in connection with his own work or to inform them thoroughly. I have no patience with a man who is afraid of losing his position in case he teaches and develops another. There's no danger, I am sure, if you take care of your end of it. These learners will help you out immensely if you let them, and they render you and the company better service, and before long you may wish to use just such a man for an unexpected vacancy, one you had not foreseen. Teach them. I expect to point with pride to every such man taught by me and can, every one.

It should be the desire of every foreman to give his local men preference in promotions; he also should aim to have a man under him competent to relieve him when the management says "come up higher." It is proven that through selection and uniformly courteous treatment to employees, without any favoritism, a certain man has increased the efficiency of his men, as shown in their average hourly piecework rate, from 24.46c. in November, 1909, to 27.98c. in March, 1910, a 12 per cent. increase in winter months. This means fewer and better workmen, consequently, better results all around.

Let the foreman do away with domineering, bullying tactics all along the line, insisting that all in authority under him deal justly and kindly, yet firmly, with employees; not showing preference for a favored few, but consulting the table of earnings, which should be complete every two weeks, or at least once a month. Make the selections for promotion from the best men where executive ability is in evidence.

In piecework shops there is a tendency among workmen to pull out more than the inspection card calls for, as it will add to their income; when taken to task they show you broken pieces, declaring they were broken. This must be guarded against and can be eliminated by notifying the men that in no case will payment be made for work not authorized. It becomes necessary to do this, especially where the removed parts might enter into a combination of defects on foreign cars, denoting unfair usage.

This subject of the promotion of efficiency is so far-reaching I can but mention many items and will no doubt overlook many which the reader will consider vital. The foreman must have a rather comprehensive knowledge of repairs to foreign equipment, as well as to his own. Such matters as M. C. B. standards to be used in substitutions, safety appliance regulations, lading rules, custom rules on bonded freight, charges and credits, wrong repairs and defect carding for them, handling fire damages, retrucking wrecked cars, oiling, packing, etc., and above all, the M. C. B. rules of interchange and arbitration decisions, are items to be thoroughly familiar with. The question of wrong repairs especially should be very near his heart as such repairs are practically a loss to his company. He should aim to be the very best car inspector on the job as well as the best bill clerk and not hesitate to teach any interested employee who shows a desire to study these subjects. In this way he will pick up many a jewel in the rough. There is also the question of conserving supplies, avoiding unnecessary waste, reclaiming second-hand materials from wrecked and condemned cars, cleanliness in shops and lockers; prompt disposition of scrap, wheel and other guarantees, and prompt compliance in making required reports. Don't "cuss" men, be tidy but not fastidious, respect yourself and command it, and above all give the very best service you can to the man higher up.

From Valparaiso the fare by the Trans-Andean Railway to Buenos Ayres is £14 ($68.13) first class and £9 ($43.80) second class; 5s. ($1.22) is charged for each 11 lbs. of baggage transported, the passenger being allowed hand baggage. This is the same as the old rate for baggage, but a new and lower rate will be fixed as soon as the different interests of the road can come to some agreement.

ECONOMICAL FEATURES OF ELECTRIC MOTOR APPLICATIONS.*

BY CHARLES ROBBINS.

It is only recently that data have been available to show beyond doubt the intermittent operation of the average machine tool. When a machine shop is driven by a belt from engine to lineshaft, and from lineshaft to machine tool, it is difficult to determine with any degree of exactness the length of time any particular tool is in operation, or the average time of operation during the working day. With the installation of motors on lineshafts, it became evident that the total horse-power capacity of motors was much in excess of the power generated in the power station. This ratio is sometimes three to one, other times possibly four to one.

As individually driven tools are adopted it is noticed that the total horse-power capacity of all the motors connected to the service grows very rapidly, and that the ratio of the connected capacity to the power supplied is often as high as five or six to one, indicating that the time-load factor of the average machine tool is relatively low. This apparent difference between the connected capacity of motors and the demand on the power station has led to a careful analysis on the part of the motor builders to determine exactly the length of time tools can be expected to be in operation.

An analysis which took into account the time of loading, cutting, unloading, and other delays occasioned by miscellaneous causes, showed conclusively that it was not necessary to use a continuously rated motor; in fact, an intermittent rating on the motor for a period not exceeding two hours' continuous service answers for almost all kinds of machine tool applications. This knowledge enabled the motor manufacturer to build a more economical motor, one of smaller size, and consequently reduce the expense of applying motors to machine tools. The present-day tool equipment ought not, therefore, to be much more expensive, if any, than that of the belt-driven tool, when the cost of belting, shafting and power house equipment is considered.

When machine tools are equipped with individual motors, a graphic recording meter may be connected in the motor circuit, making it possible to have a complete log of the operation of the particular tool during its time of service. The chart furnished by the graphic meter will show the time of loading and unloading the tool, the time of cutting, all delays due to stoppages for one cause or another and the amount of power to operate the tool, which is a direct function of the work done.

A time study can be made for each tool from these charts, and knowing the theoretical time for the job an analysis can be made of the curve, furnishing information that will enable the foreman to increase the productive capacity by the elimination of delays. He will also know whether or not the tool has been working at its maximum capacity, whether the tools have been kept up to standard conditions, and in general can apply the necessary remedies.

ECONOMICS OF MOTOR DRIVE AS DETERMINED BY ACTUAL PERFORMANCE OF THE TOOLS.

The economy of the individual motor drive, due to the fact that practically the exact cutting speed can be obtained for any operation, has been pointed out. This economy is not so important, however, as that of keeping a tool in continuous operation through longer periods of time, by reducing the time required for handling and other avoidable delays.

The accepted method of capitalizing motor drives seems in general to be on the basis of the incidental savings in the workman's time. In our opinion this is not the whole story by any means. When determining the monetary advantage of motor drive, the value of time saving should be considered on the basis of its effect on the total cost, which includes the workman's labor and the investment cost per hour of the tool.

*From a paper presented at the April meeting of the American Society of Mechanical Engineers at New York. Mr. Robbins is connected with the Westinghouse Electric & Manufacturing Company.

In addition to workmen's wages, every shop has the following expenses:

a Interest and depreciation on cost of buildings and accessories.

b Repairs and renewals to existing equipment.

c General operating expenses, including losses due to defective workmanship, design and material.

d Salaries of supervisors, engineering staff and clerks.

These overhead charges must be included in the cost of any manufactured article. A method frequently employed is to determine from time to time the percentage which the total overhead charge bears to the cost of total actual or productive

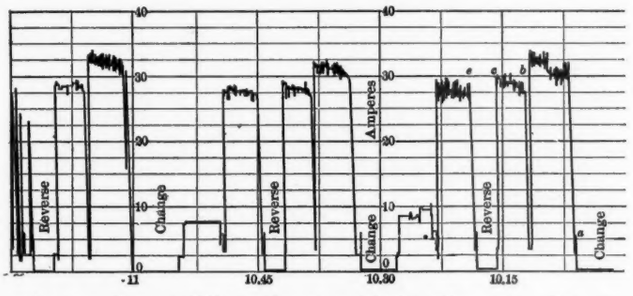


Fig. 1—Record When Turning Shafts Shown in Fig. 2.

labor. This percentage in large shops reaches from 100 to 200 per cent., or even more. The total labor charge is then obtained by multiplying the actual labor cost by one, plus the per cent. to be added for the overhead charge. This is an easy way to take care of the overhead charge; but the method is inaccurate and does not show the relative importance of different types and sizes of machines. This statement is especially true where a great variety of materials is manufactured, in shops using a large number of different types and sizes of tools. Under such conditions, the percentage obviously varies within wide limits for different kinds of work.

A satisfactory method of distribution is to set off against each tool its proportion of the total overhead charges. The portion chargeable to each tool depends entirely on local conditions; and thorough familiarity with these conditions is needed in order to apportion these charges equitably. In this way, the relative importance of each machine is taken care of.

In a shop where only one type of article is manufactured and the castings are passed from one machine directly to the next, a simple and logical way is to divide the total overhead charge among the tools, in proportion to the floor space charged to each tool. In the majority of shops, however, the above simple condition does not exist; several sizes and kinds of articles are usually turned out, and various sizes and types of tools, differing greatly in their operating characteristics, are employed. In such cases, not only must the floor space be considered, but also the time each tool is actually in operation, the nature of the work and the amount of supervision and engineering attention needed.

Large shops handling different classes of materials are in most cases divided into various departments or sections, and each section may be considered as a separate smaller factory. The overhead charges against each department may thus be apportioned among its tools in proportion to the floor space occupied, making proper allowance for special local conditions, or special supervision or engineering attention. Here again is required thorough familiarity with both the engineering and the shop features of the materials manufactured. In our experience we have found the overhead charges to be approximately as follows:

Variable charges	From	50	to	55	per cent.
Salaries	"	25	"	30	"
Interest on cost of machine tools	"	5	"	10	"
Depreciation on cost of machine tools	"	5	"	10	"
Fixed charges			"	3	"
Power	"	1	"	2	"

DEFINITIONS OF TERMS.

In discussing the economics of motor drive there will be a number of terms used which are here given with our interpretation of their meaning.

Applied to the operation:

Time factor = ratio of actual cutting time to total time required to complete a machining operation

$$= \frac{\text{Actual cutting time}}{\text{Total time to complete operation}}$$

Applied to a Machine Tool:

$$\text{Time factor in per cent.} = \frac{\text{Total daily actual cutting time in hours}}{\text{Total number of working hours}} \times 100.$$

Average running load = average input to motor while operating, usually expressed in kilowatts, but may be expressed in per cent. of full load input.

For rough calculation in this paper the input of a motor in kilowatts is assumed to be the same as the output in horsepower; that is, the motor efficiency in all cases is assumed to be about 75 per cent. This low percentage will take care of the fact that motors operate at light loads a considerable part of the time.

Maximum load = maximum input to motor, expressed in same terms as the average running load.

Average load = *Average daily load* = average input to motor during the total working hours; usually expressed in kilowatts. This load multiplied by the total number of working hours gives the total kilowatt-hours consumed per day, and is the basis of payment for energy. The average load multiplied by the number of hours per day and by the price per kilowatt-hour gives the cost of energy per day. The average load also equals the average running load multiplied by the time factor.

Load factor = the ratio in per cent. of the average daily load to full-load rating of the motor, or

$$\text{Load factor} = \frac{\text{Full load rating of motor}}{\text{Average daily load}}$$

CONDITIONS ENTERING INTO OPERATION OF MACHINE TOOLS.

In order to obtain a maximum output from a machine tool, a careful analysis must be made of all the conditions entering into the operation of the tool. One method of doing this in the case of a motor-driven tool is to take power readings at frequent intervals and lay these out on a chart basis. Another, and a much more convenient method, is the employment of a suitable meter, as already described, designed to make a graphic curve, showing the exact condition occurring in the service when such a meter is applied to any motor-driven tool.

Fig. 1 shows a record obtained while shafts of the dimensions shown in Fig. 2 were turned from machinery steel. Both Fig. 1 and Fig. 2 are lettered for reference. The records read from right to left, as indicated by the time at the bottom of the curve in Fig. 1. The vertical co-ordinate is in amperes, the full scale being 50 amperes. This current at 220 volts corresponds to 11-kw. input to the motor. At the extreme right the record indicates zero power; that is, the motor was standing idle. During the interval marked "change" the stock to be turned was placed in the chuck of the lathe. At *a* the current increases for a very short interval to about 3 amperes, while the lathe was running idle. The current then suddenly increases to about 30 amperes, due to the fact that the cutting tool was fed against the stock and the cut started. The current remains at this value for a period of about five minutes while the cut *AB* is taken, changing the diameter of the stock as indicated in Fig. 2. At *b* the current drops to three amperes, the motor running idle while adjustments of cutting

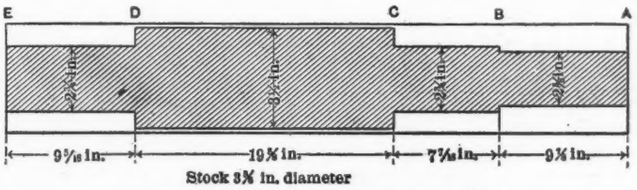


Fig. 2—Shaft of Machinery Steel.

tools are made. The current then increases to 28 amperes while the cut *BC* is taken. At *c* the machine is stopped to reverse the half-completed shaft for machining the opposite end. At *e* the machine is again started and the current increases to 27.5 amperes while the cut *ED* is taken. Another adjustment of the diameter is then made, the machine running idle for a short interval. From 8 to 10 amperes are required when the final cut *DC* is taken, after which the machine is stopped to remove the completed shaft. A similar cycle is repeated when the next shaft is turned.

The record shows three completed cycles, covering the time

required to complete three shafts. At 11:15 a. m., before taking the cut *ED*, there are sudden fluctuations of current; the form of the curve compared with other cycles shows clearly that some trouble was encountered with the cutting tool or work, and the adjustments made. The record also shows the delay in time.

Table 1 is a summary of the data obtained from the graphic record, part of which is shown in Fig. 1. Observations of cent. and its minimum value is 30 per cent. The load factor is 25 per cent. under normal conditions. It must be obvious that, with a given rate of cutting, the fewer the delays the higher will be the time factor. The magnitude of the records is an indication of the rate of removing metal, as will be further explained.

By means of this meter record it is possible to discover all delays, and to check the rate of cutting metal. Those are the

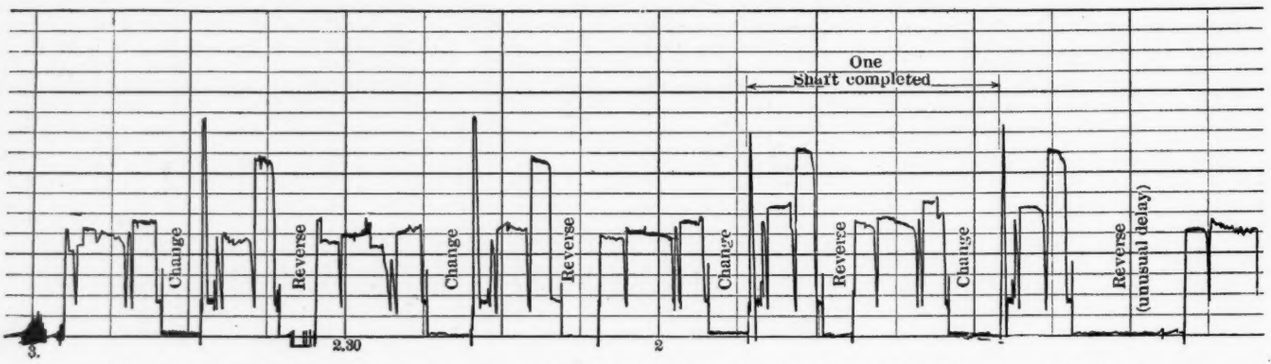


Fig. 3—Record Made When Turning a Light Shaft Which Could be Placed and Removed by Hand.

cutting speed and feed were taken at the lathe. The cutting speed used while turning these shafts was 55 to 60 ft. per min. The feed while taking the cuts *AB*, *BC* and *ED* was 0.04 in. per revolution, and while taking cut *DC* was 0.077 in. per revolution. The normal time to complete a shaft was from 27 to 32 min. In case of shaft No. 1 the time was 62 min.; this was the first shaft, turned after starting work, and preliminary

Table 1—Analysis of Time and Power of a Lathe Operation.

Shaft	Time	Mins. Amps.	Cutting AB	Cutting BC	Cutting ED	Cutting DC	Mins. %	Total Cutting	Change	Reverse	Adj. Tool	Misc.	Comp.	Time Factor	Load Fact.
1	7.30	Mins.	5.1	3.7	4.9	4.9	Mins.	18.6	5	5	13.0	21.2	61.8		
		Amps.	23	22	22	5	%	30	8.1	8.1	19.5			30	13
2	8.05	Mins.	5 3	3.9	4 4	4.4	Mins.	18 0	4.7	2.4	4.4		29.5		26
		Amps.	25	23	24	5	%	61	15.9	8.1	14.9			61	
3	8.30	Mins.	5 0	3 7	4 8	4.6	Mins.	18 1	7.5	2.4	1.9		29 9		
		Amps.	29	25	24	7	%	60.5	25	8	6.4			50.5	26.5
4	9.05	Mins.	4.5	3.4	4 8	4.7	Mins.	17.4	3.2	8.9	2.3	27.1	31.8		
		Amps.	31	29.5	24	6	%	54.8	10	27	7.2			54.8	25
5	10.05	Mins.	5.1	3.8	4.5	4.7	Mins.	18.1	5	2.5	1.3		54.0		
		Amps.	29	26	25	6	%	33.5	9.3	4.7	2.4			33.5	14.6
6	10.30	Mins.	4.9	3.6	4.6	4.9	Mins.	18.0	4.3	2.4	2.0		26.7		
		Amps.	28	25	25	5	%	67.5	16.1	9	7.5			67.5	25
7	11.00	Mins.	5.0	3.7	5.4	5.1	Mins.	19.2	5.5	2.6	2.7		30.0		
		Amps.	29	26	24	4.5	%	64	18.4	8.7	9			64	27

adjustments, oiling lathe, etc., consumed 21 min.; 12 min. were required to adjust the cutting tool. In the case of shaft No. 5, 54 min. were required on account of a 27-min. delay. The amperes referred to in Table 1 are those above the 3 amperes required to run the machine idle; they are, therefore, a measure of the power required to remove the metal. The time factor averages 53 per cent.; its maximum value is 67 per

two fundamental factors which determine the rate of output on machine tools. Any deviation from the standard cycle of operation is at once detected from the form of the record. Observations of cutting speed and feed need be taken in only one case. The record will not only show the deviation therefrom, but will also indicate whether the modification is an improvement or a drawback to the rate of output. Fig. 3 and Fig. 4 show two records taken on the same roughing lathe, operated by the same man, but turning two different shafts. The shaft turned while making the record shown in Fig. 3 was light, and could be removed and replaced in the lathe by hand. That turned when the curve in Fig. 4 was obtained was heavy, and required crane service. The greater intervals between cutting operations, so apparent in the case of Fig. 4, were due to delays in obtaining crane service to handle the heavy shaft.

Records taken during several days of operation showed an average of 5 min. longer time required for every change and reversal when made by crane. This condition was remedied soon after making the test, by installing a jib crane next to the lathe, and the time to complete the larger shaft was thereby reduced from 55 min. to 45 min., a saving in time and cost of about 20 per cent. The overhead charge against this tool was 60 cents per hour, or $6 per 10-hour day. The operator received $3.50 per day, making a total daily expense of $9.50. Before the jib crane was installed ten shafts were completed per day, making the cost of actual labor and overhead tool charge $9.50 divided by 10, or 95 cents per shaft. After the improvement, 12 shafts per day were completed with the same overhead charge, thus reducing the labor and over-

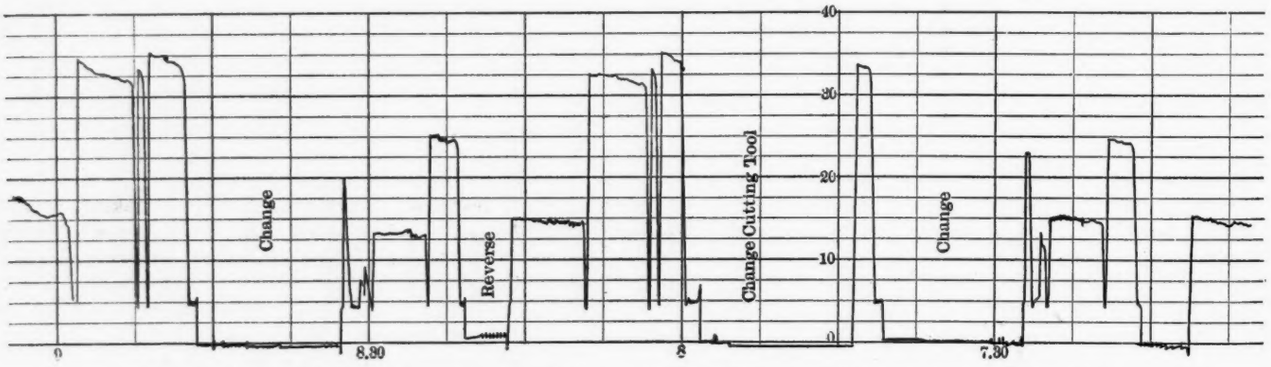


Fig. 4—Record Made When Turning a Heavy Shaft Which Required a Crane for Handling.

head tool charge to 79 cents per shaft. Such a delay seems self-evident, after it has been discovered, but in a large shop where everybody is busy small delays are easily overlooked. An automatic recording meter reveals delays caused by grinding and replacing tools, etc., besides those just indicated.

The elimination of delay, however, is not the only advantage to be obtained from the use of a recording meter. Fig. 5 and Fig. 6 are meter records which show rates of cutting on a shaft with the dimensions given in Fig. 5. In Fig. 5 the cutting speed was 50 ft. per min. The feed for cuts *AB*, *BC* and *ED*, was 0.05 in. per revolution, and for *DC* was 0.072 in. per revolution. The same feed was employed for corresponding cuts in Fig. 6, but the cutting speed was 100 ft. per min. It will be noted that the current above friction load in Fig. 6 is double that required for similar operations in Fig. 5. The saving in time is clearly shown. An analysis of records of this kind, taken over a period of several days, gives a means of determining the most economical feeds and cutting speeds to employ on a given operation.

Table 2 shows the time relation between the various operations in roughing the shaft, outlined in Fig. 5. Approximately the same conditions were found with shafts of other characteristics. The time factor of lathe operation for this class of work is thereby shown to vary from 28 to 65 per cent., the average being about 50 per cent.

An investigation by personal observations over a short period of time often leads to erroneous results, as is shown by the following experiments: In turning shafts on a roughing lathe, the first trial was with a cutting speed of 80 to 100 ft. per

Table 2—Time for Roughing Shaft, Extreme Conditions.

	Average Condition		Best Conditions		Poorest Conditions	
	Minutes	Per Cent of Total Time	Minutes	Per Cent of Total Time	Minutes	Per Cent of Total Time
Removing and replacing shafts	6.0	38	2.8	23	14.9	50
Adjusting tool	1.7	11.0	1.4	12	6.7	22
Cutting	8.0	51.0	8.0	65	8.4	28
Total	15.7	....	12.2	....	30.0	.....

min., and a feed of 0.026 to 0.044 in. per revolution. In the second case, a cutting speed of 40 to 50 ft. per min. at a feed of 0.05 to 0.07 in. per revolution was employed. A single job could be completed in either case in 16 min., 12 min. being required for cutting. However, the average time per shaft, during several days' operation, was 22.6 min., with the higher speed, and 21.6 min. with the slower speed. The same number of cubic inches of metal per minute was removed in each case; but with the higher speed, more frequent regrinding of tools was necessary, resulting in more delays and giving the lower speed five per cent. advantage in time saving.

USES OF THE GRAPHIC RECORDING METER.

By means of the graphic recording meter, the following improvements in shop management can be effected:

a If individual motors are used to drive machine tools, the exact percentage of total working hours consumed in actual cutting can be determined; it is found to average from 40 per cent. to 50 per cent., the maximum being as high as from 60 per cent. to 65 per cent. where the cut is of long duration; the minimum from 20 per cent. to 30 per cent. where jobs are short and the delay long in waiting for material, drawings, etc.

b The meter reveals all delays and suggests measures for eliminating those not necessary and reducing all others to the minimum, thus materially increasing the time factor. All delays shown should be accounted for, and an attempt made to avoid them. Common delays are in assignment of the next job, in obtaining drawings, tools and other necessary materials, and in waiting for crane service.

c The rate for cutting indicated by the power consumption of motor-driven tools can be checked with a recording meter. The maximum rate is limited only by the nature of the work, the strength of the machine tool and of the cutting tool.

d The rate for maximum economy can be determined for different classes of work; and the records, considered as standard, can be compared with other operations of the same character to see whether the proper rates of cutting were used. In a finishing operation the rate depends upon the accuracy required. A record can be made while an expert machinist

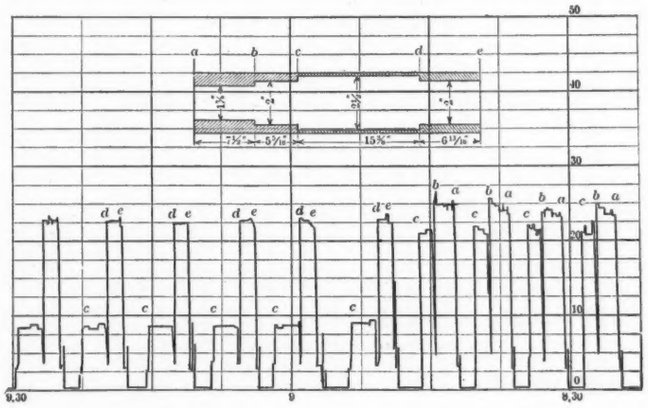


Fig. 5—Record Taken When Turning Shaft Shown on Diagram.

does the job, and this record should be referred to when other jobs of similar character are machined.

By the use of curve-drawing meters, and a careful study of the data obtained, the superintendent of a shop in which the individual motor-drive system is employed can set a limit fair both to employer and employees, for roughing, finishing, adjusting and setting-up. Different methods of doing the same job can be compared to determine which is the most efficient.

The graphic meter need not be located near the machine to which it is connected, but may be placed in the foreman's office. Small leads connected to a shunt, or to a series transformer, according to whether direct current or alternating current is employed, are all the wiring required. The wiring can be so arranged that the connections of the meter can be readily transferred to any one of several tools; thus a single meter can be made to serve a group, or any number of tools,

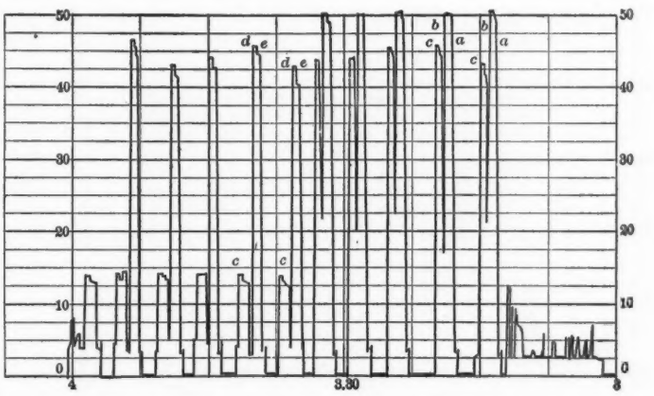


Fig. 6—Record When Turning Same Shaft as in Fig. 5 at Double the Cutting Speed.

depending somewhat upon the frequency with which the records are required.

So far we have dealt chiefly with the time required to do machining operations, time being a most important consideration with shop managers and those who use machine tools. The power consumption, however, is also of some importance, especially to those requiring motors for machine tool operation.

RELATIVE ECONOMY OF LINESHAFT AND INDIVIDUAL MOTOR DRIVE.

An increase in economy of operation of manufacturing machinery can be effected in two ways: First, by reducing the power required to operate the machinery, by saving of friction load, etc.; second, by reducing the time required for a

given operation, or, in other words, increasing the output in a given time. When confronted with the problem of deciding between the continued use of an existing lineshaft drive, or an individual motor drive, or when deciding between the two methods for a new installation, the problem should be considered in all its phases, as outlined in Table 3. This table includes every important item to be considered, except one; and in every case the advantage is with the motor.

Comparing the first cost is possibly the first consideration to enter the mind of most men, and this is the one consideration omitted from Table 3. That this consideration is relatively of minor importance will be evident, when the saving in power consumption and in time, made possible by individual motors, has been considered.

SELECTION OF MOTOR AND TOOL EQUIPMENT.

In the selection of a motor-driven tool, there are certain features which should be taken into account and properly analyzed, and specifications drawn to cover them. If a tool is for specialized manufacturing, there should be specified:

Table 3—Comparison of Lineshaft Drive and Individual Motor Drive for Machine Tools.

Item	Lineshaft Drive	Individual Motor Drive	Advantage of Individual Motor
1 Power consumption	Constant friction loss in shafts, belts and motor, power for cutting	Friction loss (motor and tool only); useful power only while working	Less power required
2 Speed control	No. speeds = no. cone pulleys × no. gear ratios	No. speeds = no. controller points × no. gear ratios	More speeds possible; time saved in speed adjustments
3 Reversing	Clutch and crossed belt	Reversible controller	Time saved in reversing
4 Adjusting tool and work	Stopping at any definite point, very difficult	Can be started in either direction and stopped promptly at any point	Time saved in setting up and lining up
5 Speed adjustment	Large speed-increments between pulley steps	Small speed increments between controller steps	Time saved by obtaining proper cutting speed
6 Size of cut	Limited by slipping belt; large belts hard to shift	Limited by strength of tool and size of motor	Time saved by taking heavier cuts
7 Time to complete a job	.....	.....	Much less time required as indicated for previous items
8 Liability to accidents	Slipping or breaking belts; injury to machine tool; cutting tool or prime mover	Injury to machine tool, cutting tool or motor	Much less liability to accidents
9 Checking economy of operations	Close supervision required: very difficult to locate causes of delay	Accurate tests possible by means of graphic meter which records automatically all delays and rate of cutting	Causes of delay and remedies easily located without personal supervision
10 Flexibility of location	Location determined by shafting, and changes difficult	Location determined by sequence of operations; changes readily made	Greater convenience in handling and increased economy of operation; more compact arrangement possible

a The exact class of work which the tool is to accomplish.

b If the power required to remove the metal is not known, then a statement should be made as to the approximate feed and cutting speeds to be taken.

c Careful analysis should be made of the time required to load and unload the machine, to determine the feasibility of employing auxiliary means other than manual labor for loading the tools.

d From this information, an approximate determination can be made as to the intermittency of operation of the tool, in order to decide whether an intermittently rated motor or a continuously rated motor will be required.

e By a knowledge of the physical shape of the work, determination can be made as to whether an adjustable-speed motor will result in economy of time, if used on this particular class of tool.

f Will enable the tool builder to determine upon the proper type of controller, and its most desirable location from an operating point of view for the workman.

If a special type of tool is not desired and it is preferable to purchase one with such characteristics that it can be used for general manufacturing, one should determine as nearly as possible the range of material or work for which it will be used in straight manufacturing operations. A knowledge of this will undoubtedly permit of a better motor and tool selection, than the simple purchase of a standard stock tool.

It should be realized that under present schemes of operation few tools are in operation more than 50 to 60 per cent. of the time, whereas, the load factor of those tools may be as low as from 10 to 40 per cent. Thus we have it brought home to us clearly that much of the time the tool is in idleness and is often operated at much less than its maximum capacity.

The direct-current motors are built for speed adjustment over a range of 1 to 2, 1 to 3, and in some instances 1 to 4. With the proper selection of controller the speed adjustments may be made in small increments of from 10 to 15 per cent., and since these small increments of speed adjustment are available, it is essential that a controller be selected of such type that it can be mounted conveniently to the operator, so that he may take full advantage of them.

Where it is necessary to employ the alternating-current motor, it may be absolutely essential to employ a gear box to obtain the various speed adjustments. When such a machine is employed, the fine gradation of speed obtainable with a direct-current adjustable speed motor is absent, and the gear box will practically take the place of the ordinary cone pulley arrangement. It has, however, one advantage when motor-driven, and that is, that the tool is supplied with positive power at all times, and will take care of the maximum conditions without slipping or loss of power, which frequently occurs when the belt drive is used. In some instances it has been found possible to make good use of the so-called multi-speed alternating current motor. This form of motor consists in certain different types of windings, permitting of a multiple method of pole grouping, such as for instance, a speed of 1,800, 1,200, 900 and 720 r.p.m., according to the method of winding the motor. In some cases, this type of multi-speed motor, when used in conjunction with a gear box, will permit of somewhat finer gradations of speed than are possible with a constant-speed alternating-current motor and a standard gear box.

GENERAL CONCLUSIONS.

The economical operation of a machine shop requires a thorough analysis of all the operating costs; that is, overhead and operating charges of all kinds, and an accurate knowledge of the operating conditions of all machine tools. Investigations of these conditions must be conducted by someone familiar with both the engineering and the shop features of the apparatus manufactured. The investigator should also be familiar with the characteristics of the various types of motors and methods of control, in order that the most advantageous electrical equipment as well as the best machine tool equipment may be installed, with suitable tools for different sets of conditions.

Such investigations lead to the following improvements which result in increased productive capacity:

a More flexible arrangement of tools.

b Greater facilities for handling materials at the tools.

c Greater facilities for handling materials between tools.

d Better facilities for obtaining auxiliary material, drawings, tools, etc.

e Better facilities for making adjustment of the tools during machinery operation.

f Removal of causes of unsuspected or avoidable delays due to small accidents and improper characteristics of the drive.

g All lost time, due to whatever cause, and which can be avoided, is immediately brought to the attention of the superintendent, and an analysis of these losses will result in their elimination.

Shop Kinks.

CHICAGO & NORTH WESTERN.

The Chicago shops of the Chicago & North Western have been regarded for years as among the best managed railway shops in the country. Although the plant is a very old one and the men are paid on a day-work basis, few, if any, shops of the same size have been able to equal it, either as to output or efficiency. It is not surprising, therefore, to find an exceptionally large number of labor-saving devices or kinks in it. The ones described in this article have been selected and arranged by the foreman of the erecting shop, H. D. Kelley. Credit for developing the devices is due to the various foremen at both the Chicago shops and those at other points on the system; everyone has lent a hand in their development, from the shop superintendent down.

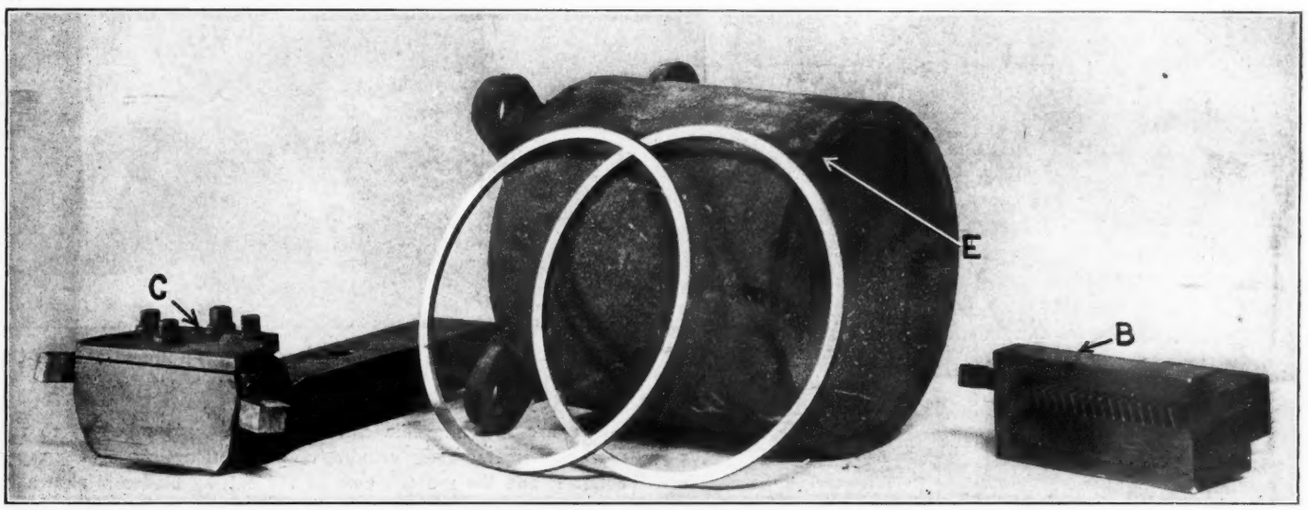


Fig. 1—Tools for Boring and Cutting Off Packing Rings for Air Pump.

PACKING RINGS FOR 9½-IN. AIR PUMP.

Packing rings for 9½-in. air pumps are made in the following manner: A cast iron cylinder or barrel, large enough to make 25 rings, is bolted on the face plate of a lathe, and the inner edge E, Fig. 1, is turned off in order that a plug center may be forced against it while the cylinder is being turned on the outside. The outside, after it is turned, is filed smooth. The gang tool B, having 16 cutting tools, spaced $\frac{3}{32}$ in. apart, is then used to space off 24 rings in two operations, cutting in to a depth of $\frac{1}{8}$ in. The twenty-fifth ring is cut off by a special tool. The tool C is then placed in the lathe. It has two adjustable boring tools which are adjusted to the finished inside diameter of the packing ring. As this boring tool advances the rings drop off one at a time; they are of the correct inside and outside diameter, but are not of the required thickness.

The rings are finished to the proper thickness on a magnetic chuck F, shown in Fig. 2. The magnetic chuck consists of a series of electro-magnets, arranged in a circle, with rectangular heads, finished flush with the face of the chuck, as shown in the photograph. The electric current is conducted to brass discs or rings at the back of the chuck through the carbon brushes A. The brass rings are connected to the magnets. The brush holder C is bolted to the lathe, and both brushes are held firmly against the brass rings by means of springs. The inside diameter of the chuck face is equal to that of the largest size packing ring. For smaller rings the

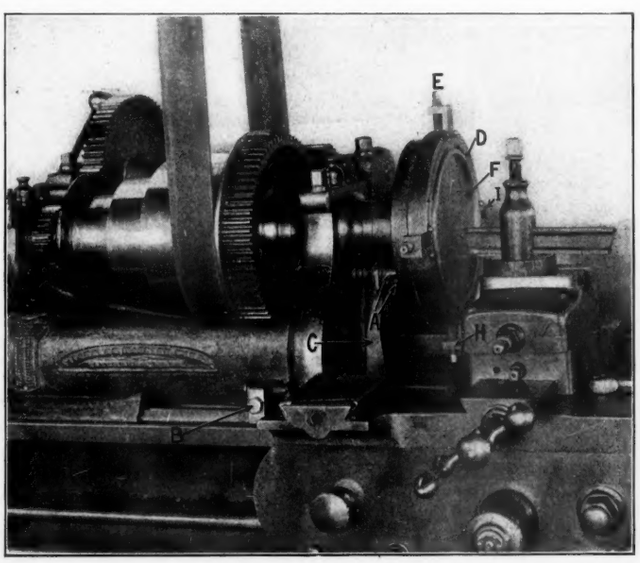


Fig. 2—Magnetic Chuck for Finishing Packing Rings for Air Pump.

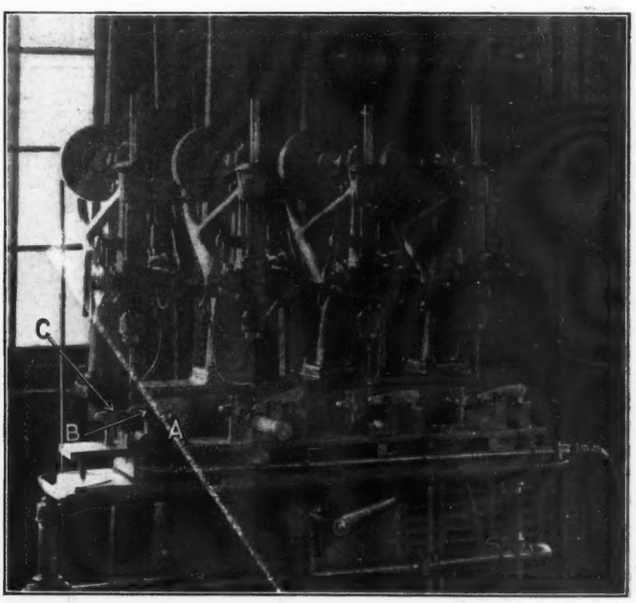


Fig. 3—Pneumatic Clamps and Jigs for Boring Holes in Pins.

adjustable dogs E, G, H and I are used to keep the ring from sliding. In the photograph a 9⅝-in. ring is shown in a 10-in. chuck. The stop B is set so that the facing-off tool will come

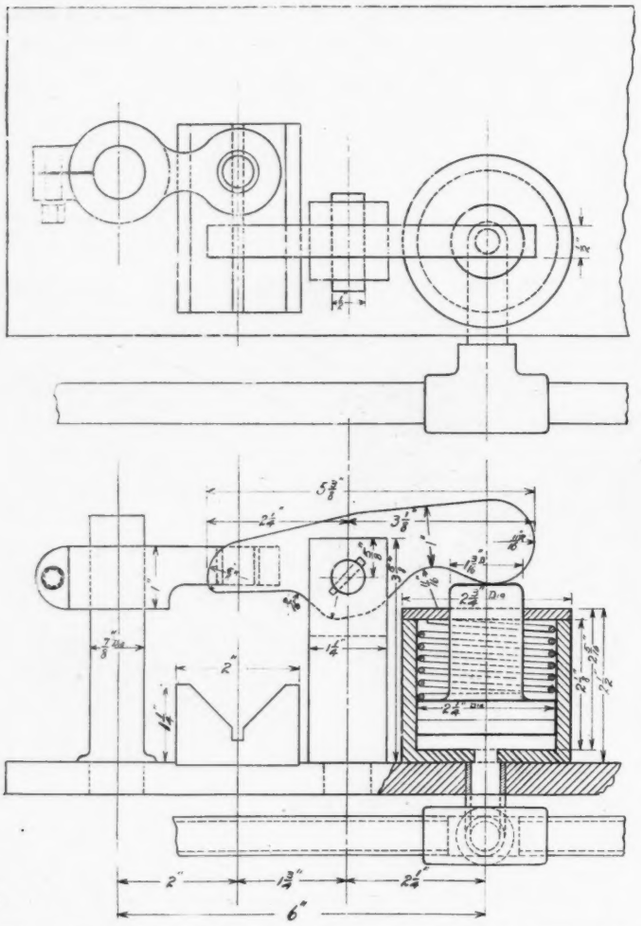


Fig. 3A—Pneumatic Clamp and Jig for Drilling Pins, Etc.

within ¼ in. of the face of the chuck. The unfinished packing ring, $\frac{9}{32}$ in. in thickness, is placed in the chuck and finished on both sides to a thickness of ¼ in. By this method one man turns out 100 finished rings per day.

PNEUMATIC CLAMP AND JIG FOR DRILL PRESS.

A four-spindle drill, equipped with a gang of pneumatic clamps and jigs for drilling holes in pins, bolts, etc., is shown in Fig. 3. To operate the clamp, air at a pressure of 85 lbs. is admitted to the cylinder A, and the lever B is forced down on the pin. The jig C is fitted with a set of bushings whose inside diameters correspond to the sizes of the drills used. The clamp is shown in detail in Fig. 3 A.

ADJUSTABLE REAMER.

An adjustable reamer, used in connection with the manufacture of 2-in. pneumatic blow-off cocks, is shown in Fig. 4.

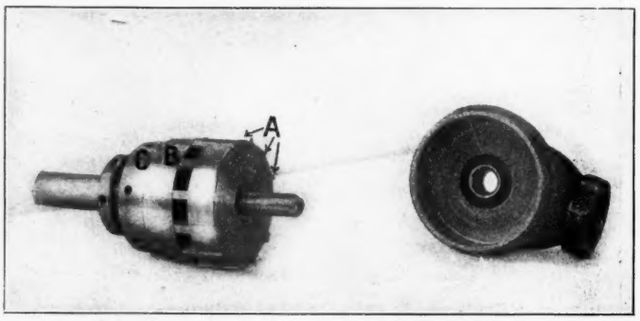


Fig. 4—Adjustable Reamer for 2-inch Pneumatic Blow-Off Cocks.

There are 12 removable cutters A, which are adjusted to the correct diameter after grinding and are held tight by the taper collar B and the nut C. One of the cutting blades is shown in Fig. 4 A. These are made to fit tightly in equally spaced slots in the 4$\frac{1}{16}$-in. head. The taper collar forces them up tight against the taper head, holding them securely. The blades may easily be removed for regrinding.

MANUFACTURE OF AIR PUMP VALVE AND SEAT.

The valve seat for an air pump, shown in Fig. 5, is manufactured in the following manner: The forging A is made by the dies and formers shown in Fig. 6, which are used in an Ajax forging machine. A piece of round iron is held in the female die at E, and is partly upset and the hole punched in it by the

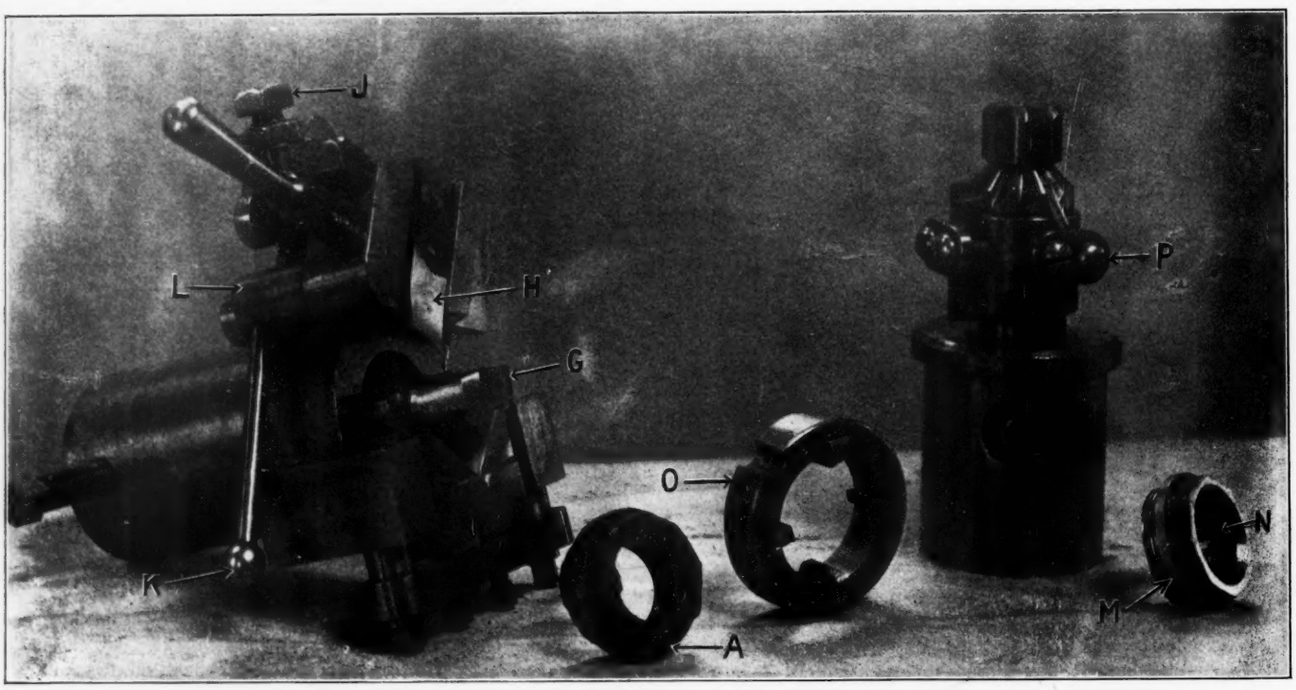


Fig. 5—Tools for Machining Valve Seat for Air Pump.

plunger B. The forging is completed in a second operation by the plunger D and the die C. It is then cut off and finished in a turret lathe by the tool shown in Fig. 5. At the first operation the reamer G faces off the threaded end and roughs out the inside; the turning tool H finishes the outside to the diameter

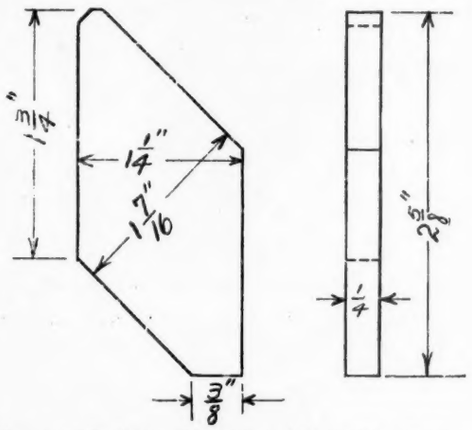


Fig. 4A—Cutting Blade for Adjustable Reamer.

of the thread. To cut the recess between the threads and the bottom of the seat at M, a lever K is thrown up and the tool takes a deeper cut, this being done by means of an eccentric L. The throw of the eccentric is regulated by an adjusting screw J. The forging is then threaded by the die O, after which it is screwed into a chuck, and the seat end is machined to the

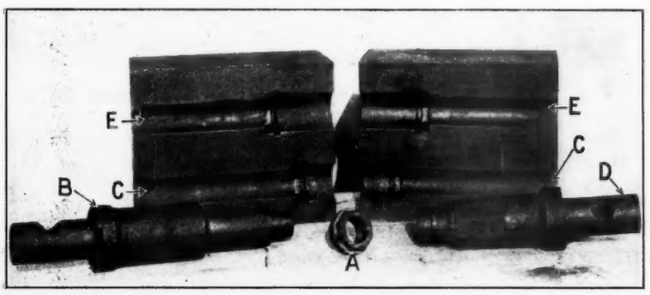


Fig. 6—Dies and Formers for Forging Valve Seat for Air Pump.

correct angle and the inside diameter is finished by a special reamer P. The valve for this seat is forged by the die shown in Fig. 7. The flanges of the valve F are flattened from the round iron at a white heat in the dies at A, B and C. The last operation is performed in D by the plunger E. These valves

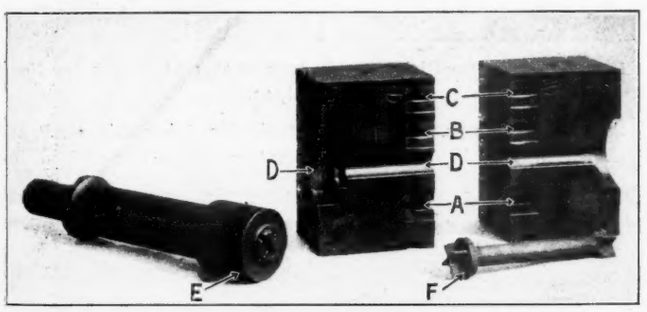


Fig. 7—Dies and Formers for Forging Air Pump Valve.

are formed on both ends of a round bar which is cut in the middle. They are then finished in a turret lathe by the cross feeding or side adjusting tool, shown in Fig. 8. The cutting tool is set for the correct angle of the valve seat and is fed across the lathe at right angles to the work. The valve A, Fig. 8, is held by a two-jaw chuck in the spindle of the machine. The cross-feeding device is bolted to the tail stock.

MILLING GROOVES IN INJECTOR WATER NUTS.

A brass injector water nut, with 50 grooves milled in the top, is shown in Fig. 9. These grooves are cut on an ordinary milling machine with the aid of the special chuck shown in Figs. 10 and 11. The chuck consists of a shell H, a 50-tooth gear C,

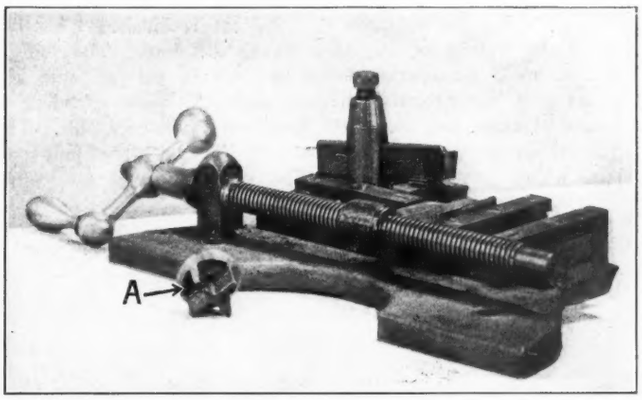


Fig. 8—Tool for Finishing Air Pump Valves on Turret Lathe.

which is feather-keyed to the shaft D that carries the head B; also a handle E, on the end of which is fastened the cam F. This cam works against the follower G, the working faces of the cam and the follower being helices. Attached to the handle is a ratchet R.

The chuck is set on the bed of the milling machine and its operation is as follows: The nut to be milled is screwed into the head B; the handle E is turned in a counter clockwise direction until the rachet R drops through the slot S in the shell H and engages the gear C, thus turning the shaft D to the proper position for the cutting of the first groove. The slot S is so designed that a movement of one-fiftieth of a turn of D is allowed. The spring I furnishes friction for holding the chuck in position, while the handle E is turned back until the slot in H stops it at A, the slot being just wide enough from A to A′ to allow the handle to pass through H. The backward movement of the handle brings the cam F into engagement with the follower G,

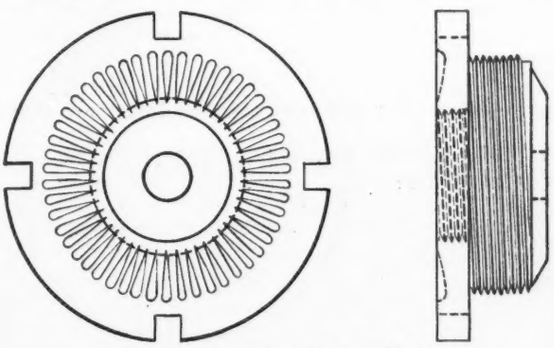


Fig. 9—Injector Water Nut.

thus raising the nut to such a height that the groove will be milled to the proper depth. The follower G is feather-keyed to the shell H so that it will not revolve with F. As the handle is turned back to its initial position the spring I pulls the chuck down, the ratchet R turns the gear C one-fiftieth of a revolution and the operation is ready to be repeated. It is possible to mill the grooves as fast as the handle can be turned back and forth.

DIES FOR STAMPING PRESS.

A set of dies for stamping gaskets for the top, bottom and center heads of a 9½-in. air pump is shown in Fig. 12. The dogs, A, B and C in the male die are removable, thus allowing the stamping of three different types of gasket with these dies. Another set of dies for stamping the copper water strainer for

feed water pipes is shown in Fig. 13. These dies are made of tool steel and are used in a No. 2½ double stripper machine manufactured by the E. W. Bliss Company, Brooklyn, N. Y.

FLUE CUTTER.

A most efficient flue cutter has been designed by B. Hendrikson, foreman of the tool room at Chicago. This tool, which is shown in Fig. 14, is so constructed that an air whistle is blown the instant the cutter wheel has made its way through the flue, thus notifying the operator that the cut is finished. Another important feature of the tool is the air feed. The tool is driven by a pneumatic motor and air is pumped into the cylinder B through the driving shaft A, thus affording a means of expanding the cutter disks out against the flue. The flue cutter in operation is shown in Fig. 15. The following test, which was made at the Chicago shops, will give some

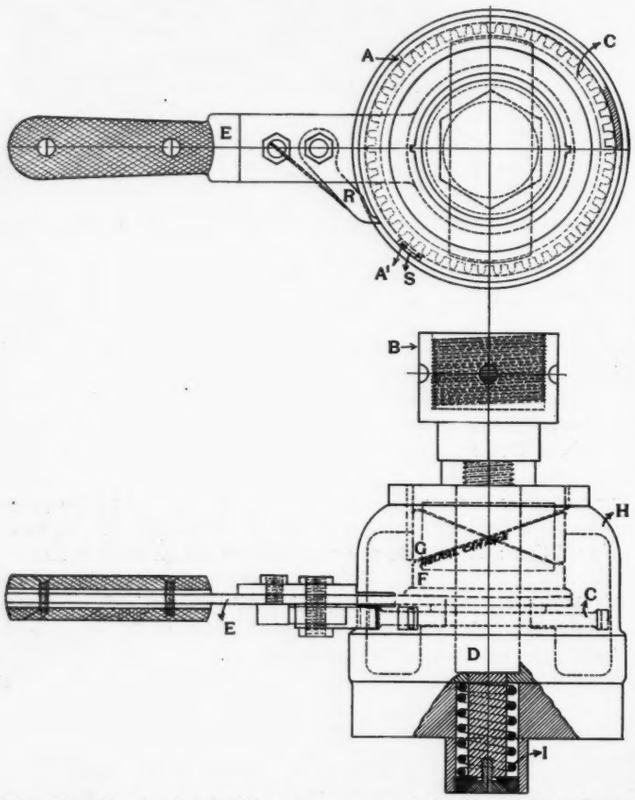


Fig. 10—Chuck for Milling Grooves on Injector Water Nuts.

idea of the rapidity with which the flues can be cut. The device is patented:

	No. of flues cut.	Time (minutes).	Air pressure.	Av. per flue (seconds).
Engine No. 294.....	125	8	85	3.8
" " 872.....	271	21	85	4.6
" " 676.....	191	13	90	4.1
" " 678.....	224	18	85	4.8
" " 318.....	291	18	85	3.7
" " 325.....	291	20	80	4.1
" " 86.....	284	15	90	3.1
" " 1075.....	338	38	85	6.8
" " 301.....	146	11	85	4.5
" " 437.....	122	11	80	5.4
" " 303.....	190	14	80	4.4

BENDING CLINKER BAR HANDLES.

A set of dies for bending clinker bar handles on a forging machine is shown in Fig. 16. The part A is bolted to the crosshead, and the base B to the bed of the machine. When A travels backward the spring H pulls the die C open as it moves backward away from the roller G. At the same time the plunger D starts backward, and as it clears the end of the die E, the spring L pulls E to the left. The clinker bar heated to a red heat is thrust in to the left of the center piece M until it strikes the stop F, which allows just enough material for bending. The crosshead then comes forward and the plunger D strikes the curved side of the die E and forces it toward the center, bending the iron about the left side of M.

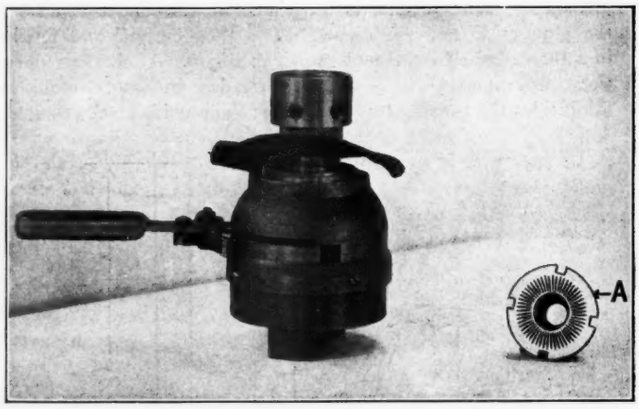


Fig. 11—Chuck for Milling Grooves on Injector Water Nuts.

The die C then comes in contact with the iron and bends it downward until the die strikes the roller G, when it is swept

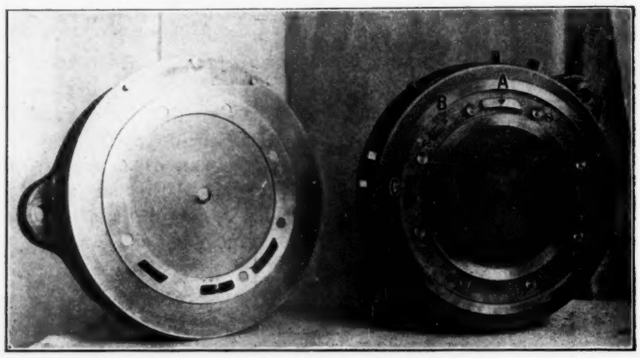


Fig. 12—Dies for Stamping Gaskets for Air Pump Heads.

inward and around the center piece M. One of the handles is shown in the foreground in the photograph.

CUTTERS FOR SLAB MILLING MACHINES.

Side rods are roughed out and finished in one operation at

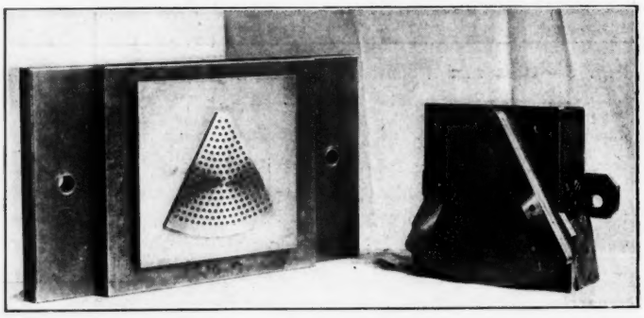


Fig. 13—Dies for Stamping Copper Water Strainers for Feed Water Pipes.

the Chicago shops. The special tools for doing this work are shown in Fig. 17. One of the cutters (there are 216 in the

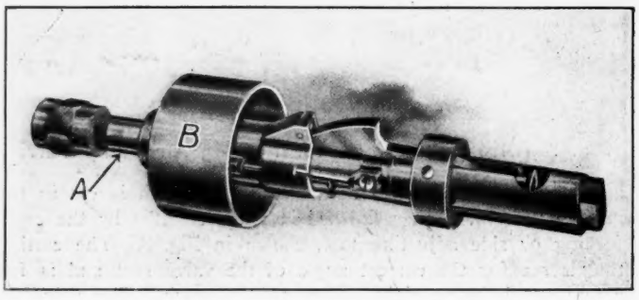


Fig. 14—Flue Cutter.

tool) is shown in Fig. 17a. These cutters are driven in straight and are kept from turning by prick-punching the arbor forcing the soft metal of the arbor into the 7/32-in. recess of the cutter. The results from these tools have been excellent. They seldom require grinding and are run at a cutting speed of 6 to 8 in. per min., taking a ½-in. cut.

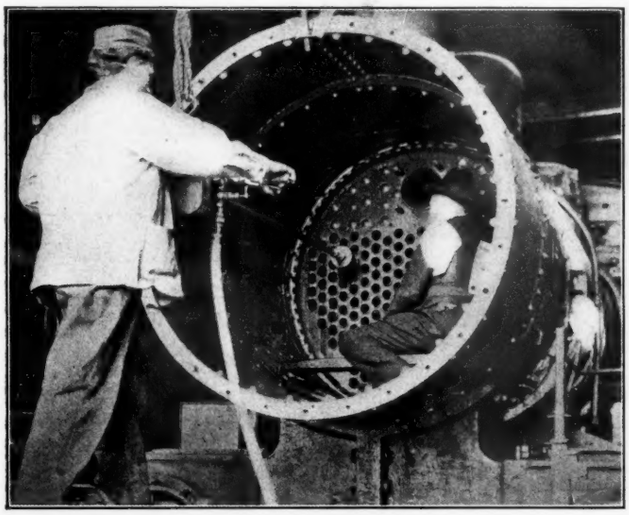


Fig. 15—Flue Cutter in Operation.

TESTING BOYER SPEED RECORDERS.

A simple device for testing Boyer speed recorders is shown in Fig. 18. It consists of a small air engine, direct connected to the flywheel of the speed recorder. An auxiliary tank and a reducing valve provide a constant air pressure, making it possible to maintain any constant speed of from one to 100 miles per hour. The pulley of the recorder turns ten times as many revolutions per minute as the number of miles per hour registered; that is, r.p.m. equals ten times m.p.h. For example, to check the recorder at 50 miles per hour it is only necessary to speed up the machine until the pulley turns 500 r.p.m. If the recorder is correct it will register the correct speed.

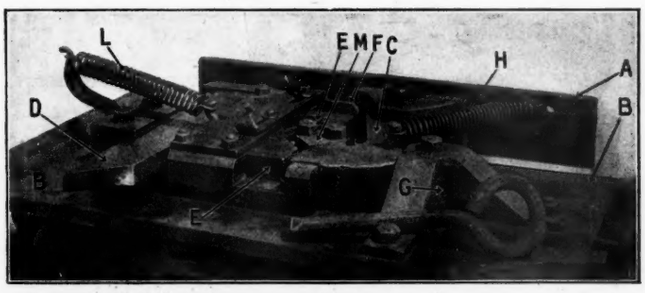


Fig. 16—Dies for Forming Clinker Bar Handles.

TOOL FOR TURNING TUMBLING SHAFTS.

A special tool for turning tumbling shafts is shown in Fig. 19. It consists of a brass sleeve A to which the tool B is bolted. This revolves about the shaft C, which is screwed on the spindle of the lathe. The tool is fed by means of the carriage and the plate D, which is fitted to the groove E at the left on the sleeve, and is held in the tool post.

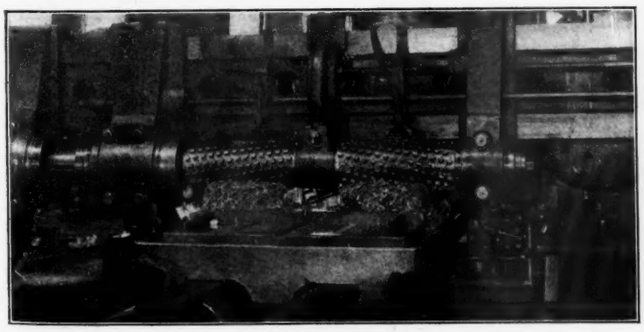


Fig. 17—Milling Side Rods.

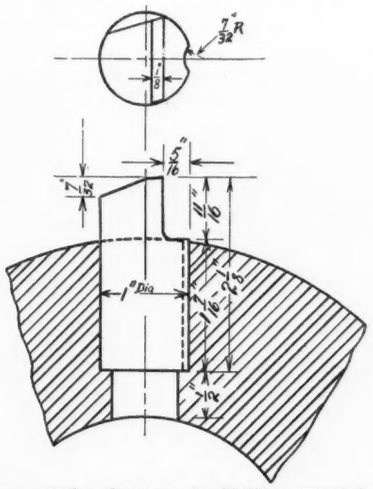


Fig. 17A—One of the Cutters in Milling Tool for Side Rods.

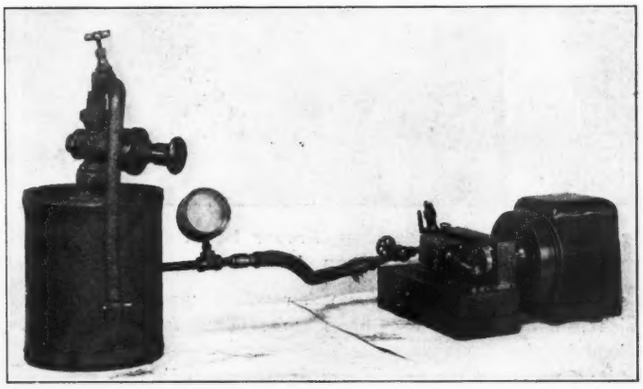


Fig. 18—Device for Testing Boyer Speed Recorders.

CHECKING LOCATION OF DRIVING WHEEL ON AXLE.

A shop kink which is used to great advantage in testing the proper location of crank pins in relation to the keyway when

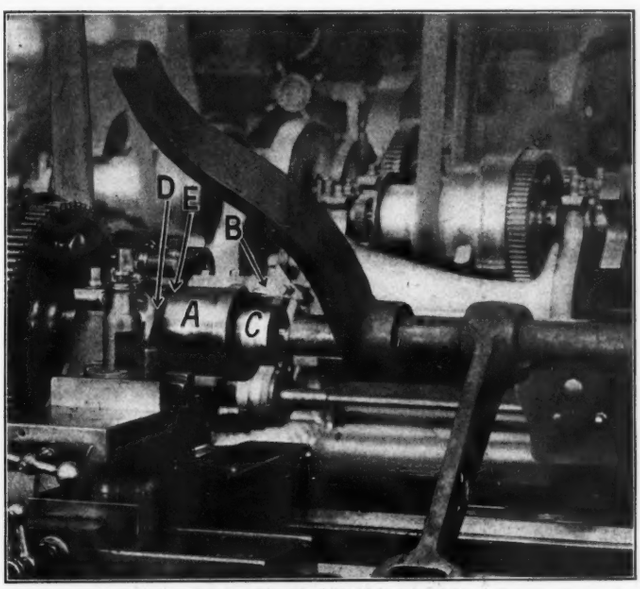


Fig. 19—Tool for Turning Tumbling Shafts.

pressing a wheel on an axle is shown in Fig. 20. The lower inside center A is placed on the center line of the keyway. The upper point B is in the same vertical plane and furnishes a guiding point in pressing the wheel to its correct position on the axle. The point B should be in the center of the crank pin when the point A is on the center line of the keyway.

DRILL PRESS CLAMP FOR ASH PAN CASTING.

A clamp for holding ash pan castings on a drill press table

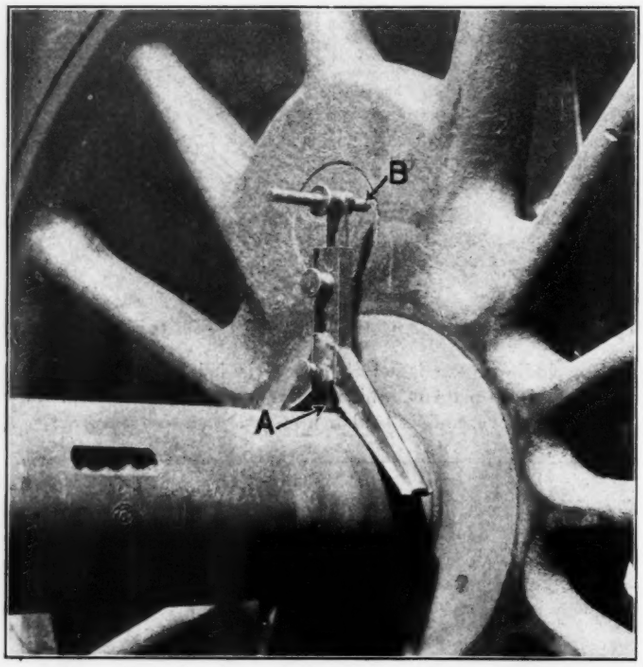


Fig. 20—Tool for Checking Proper Location of Driving Wheel on Axle.

is shown in Fig. 21. The clamp A revolves upon the shaft B, which is bolted to the drill press table. The casting C, which is held by the clamp, may be placed in any postion for drilling by driving out the key D and turning upon the pin B.

REMOVING BULL RING FROM PISTON SPIDER.

A tool of great advantage in removing the bull ring from

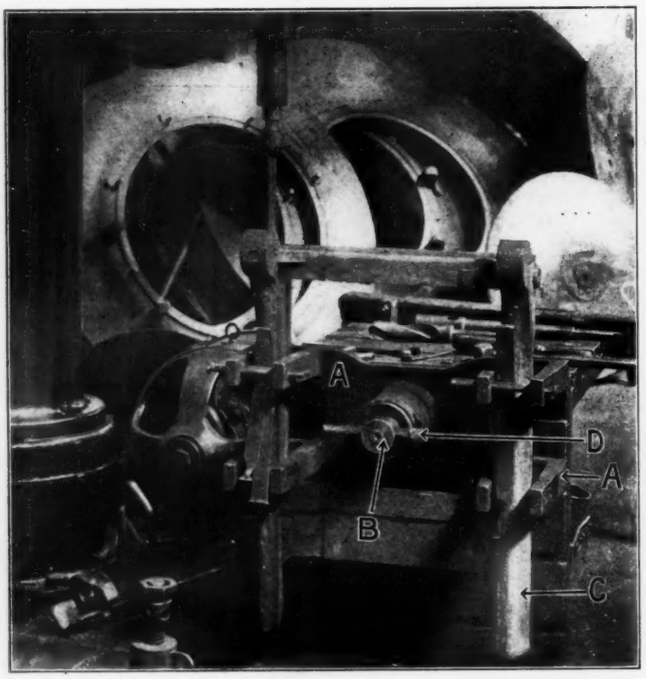


Fig. 21—Clamp for Holding Ash Pan Casting on Drill Press.

the piston spider is shown in Fig. 22. The dogs A and B attached to the cross piece C are inserted in the bull ring D,

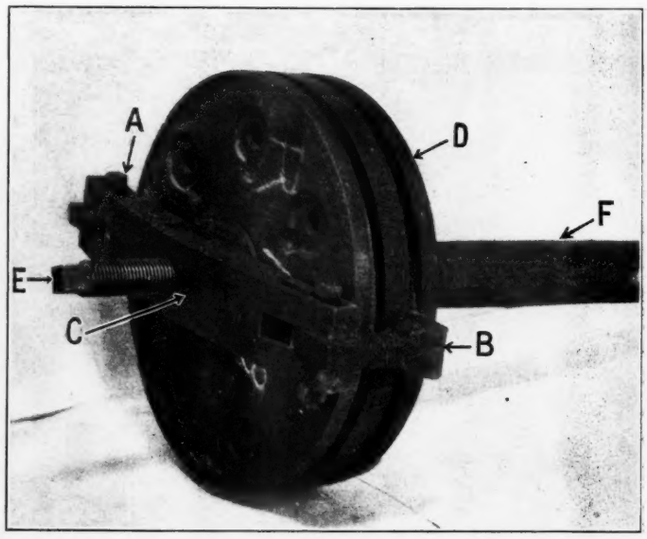


Fig. 22—Tool for Removing Bull Ring from Piston Spider.

and the screw E is forced against the piston F; the dogs A and B pull the spider off.

PISTON RING TOOLS.

Two handy tools for applying snap rings to a piston head are shown in Fig. 23. The tool A spreads the ring and B is

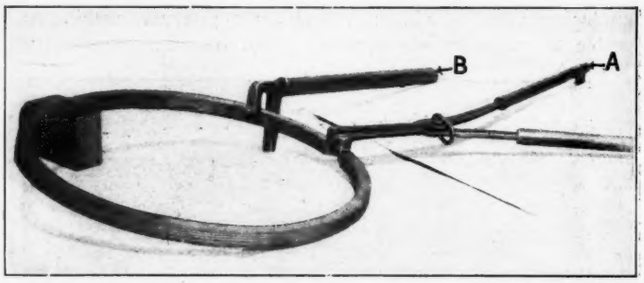


Fig. 23—Tools for Applying Snap Rings to Piston Head.

used as a lever for pulling the piston ring down into place.

PNEUMATIC LATHE FOR CHASING FOLLOWER BOLTS.

A considerable saving of time is made by the use of the small pneumatic bench lathe shown in Fig. 24, which is used

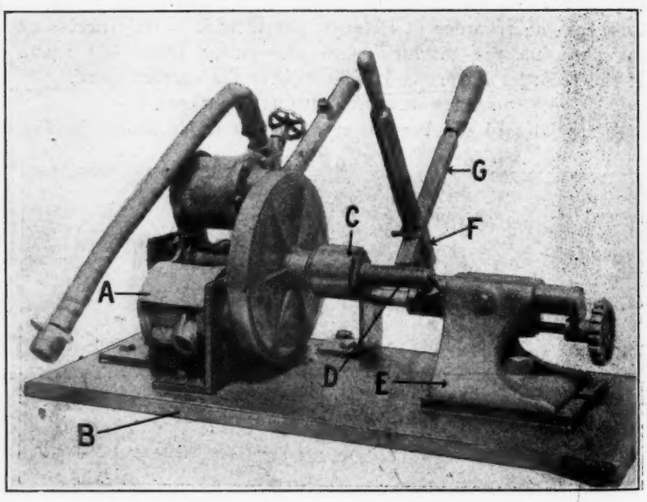


Fig. 24—Pneumatic Lathe for Chasing Follower Bolts.

for chasing follower bolts. It consists of an air motor A mounted on the base plate B; also of a special chuck C for holding the follower bolt, a tailstock E and a tool carriage F., which carries the chaser tool G. This provides a simple and easy means of chasing follower bolts at the bench and is especially useful in connection with roundhouse work.

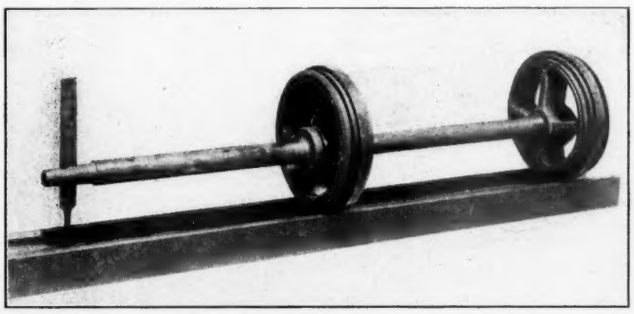


Fig. 25—Parallel Strip for Lining Up Dowel Pins on Piston Valve Spiders.

PISTON VALVE KINKS.

The parallel strip, shown in Fig. 25, is used to considerable advantage in lining up dowel pins on piston valve spiders. For the proper laying off of keyways on piston valve spiders the device shown in Fig. 26 is used. The spider A is placed in the countersunk hole on the plate B, and the parallel strip C is inserted in the slots of the tool posts D and E, as shown. The keyway is then scribed at F. It is thus located in the correct position and there is no danger of the valve binding in the steam chamber when it is connected to the valve motion.

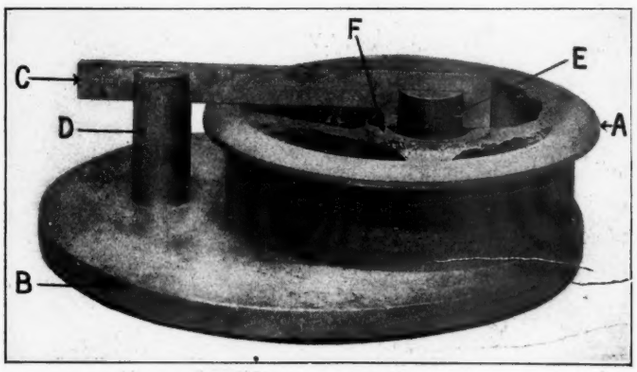


Fig. 26—Device for Laying Off Keyways on Piston Valve Spiders.

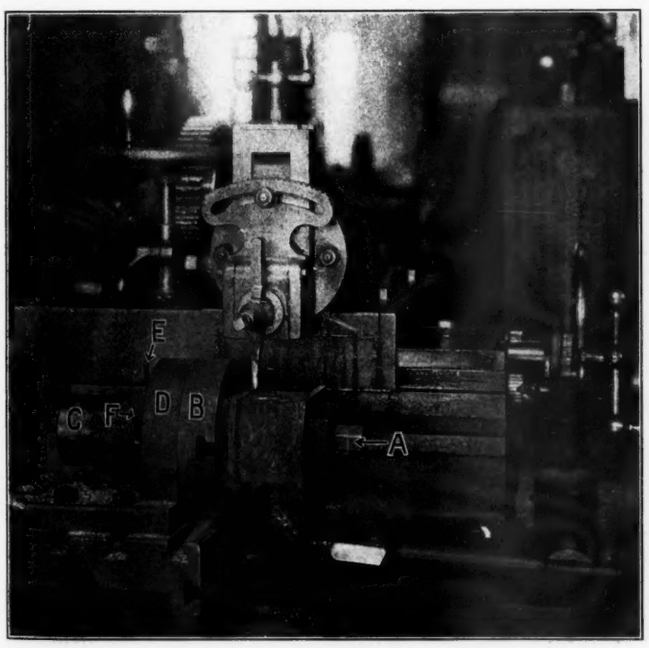


Fig. 27—Chuck for Planing Rod Brasses.

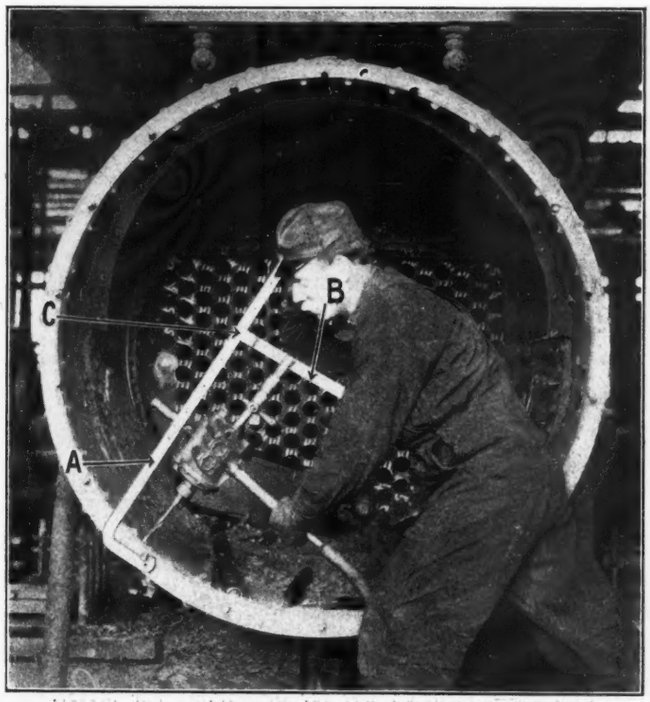


Fig. 28—A Handy Device for Drilling Small Holes in the Front End.

ROD BRASS CHUCK.

A special chuck for planing rod brasses is shown in Fig. 27. It is so constructed that the brass is planed perfectly square

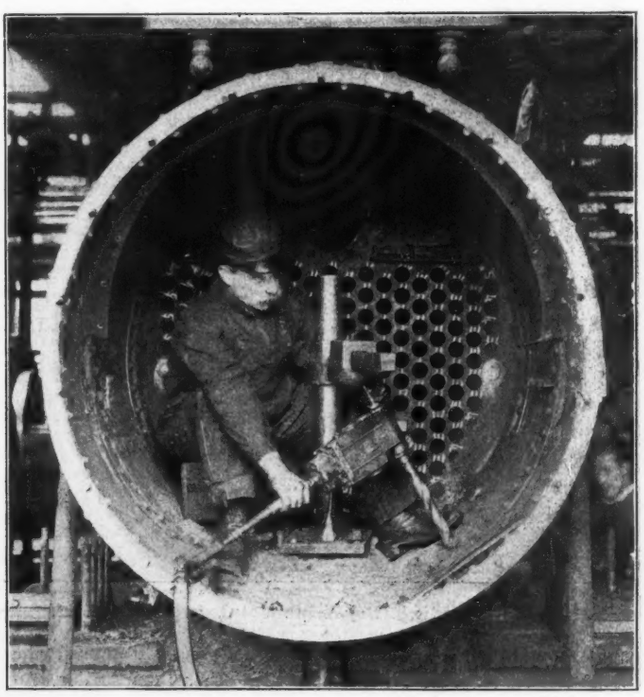


Fig. 29—"Old Man" with Ball-Shaped Head for Drilling Saddle Bolt Holes.

on all four sides without being unclamped. Means are also provided to take care of wedge brasses. The nut A clamps the brass to the chuck B; the nut C holds the chuck to the frame D. To turn the brass 90 deg. the finger E is drawn

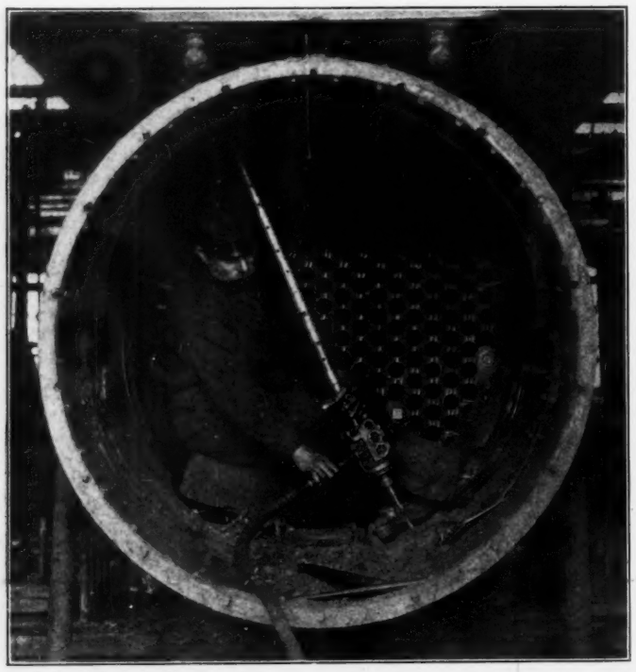


Fig. 30—Extension Bar for Supporting Air Motor.

down, disengaging a slot on the inside. The nut C is then loosened and the brass is turned until the finger E engages in the next slot on the inside face of B. This slot is cut at right angles to the first stop. The brass is turned in this way four

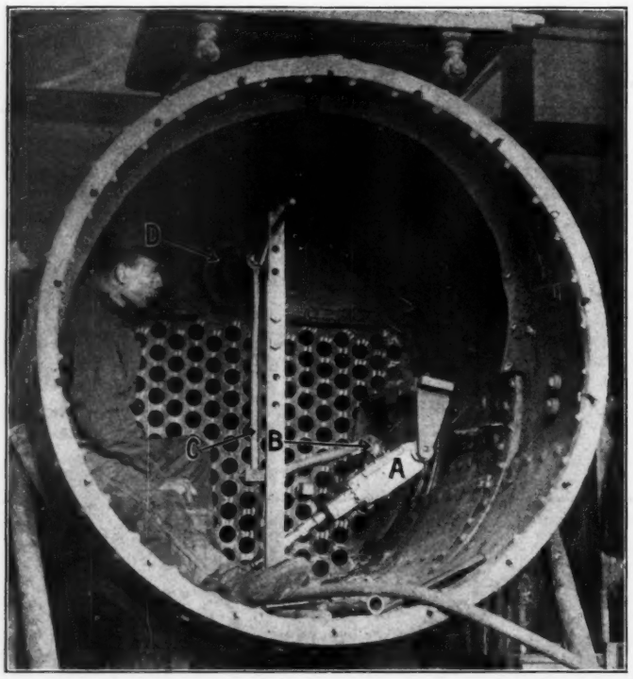


Fig. 31—Grinding Dry Pipe Joint in Front End.

times and is planed on the four sides. The finger F is used when it is desired to plane brasses at angles other than 90 deg.

DRILLING HOLES IN THE FRONT END.

The apparatus shown in Fig. 28 is especially useful for drilling holes of small diameter when it is not convenient to

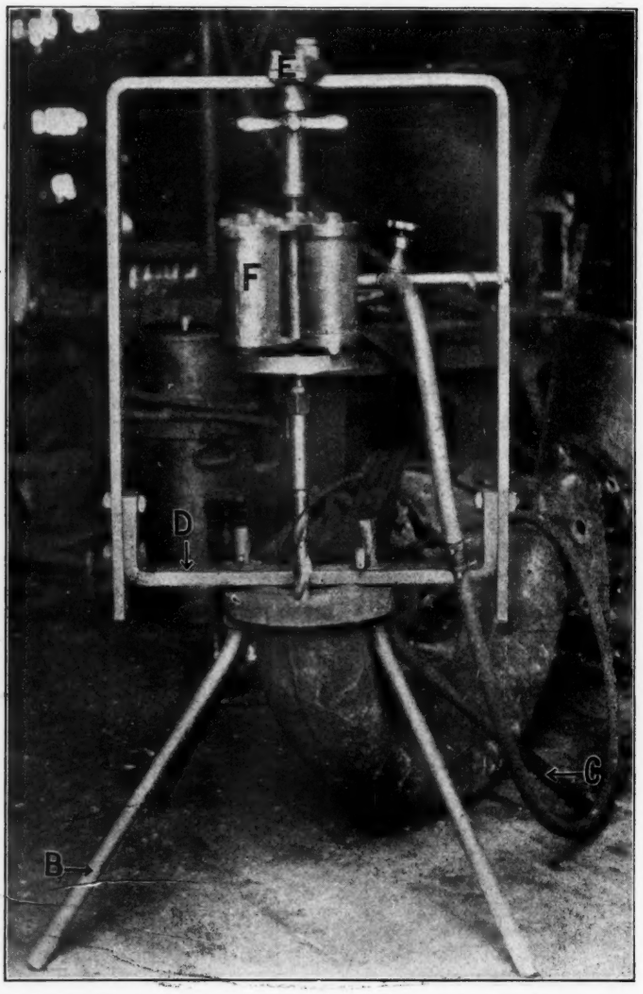


Fig. 32—Drilling Holes in Steam Pipe Flanges.

use an "old man." The long piece A is hooked over a stud or bolt at its lower end and is held at the upper end by the workman's right hand. The cross piece B is pivoted to A at C and is pressed down upon the slotted top of the motor by the weight of the workman's body.

The "old man" with the ball-shaped head shown in Fig. 29

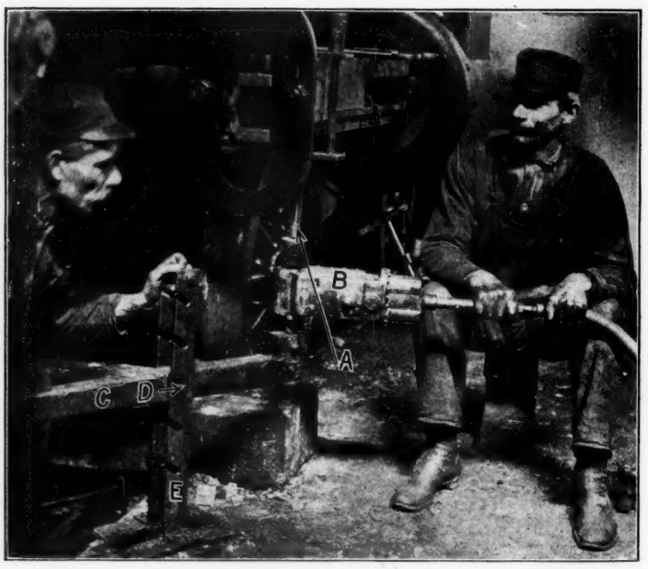


Fig. 33—Reaming Guide Bolt Holes.

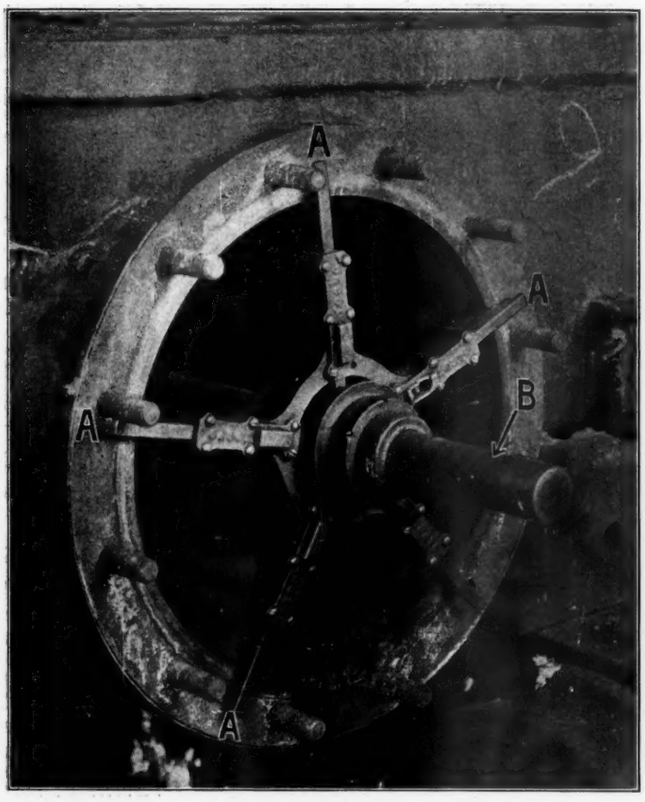


Fig. 34—Adjustable Device for Lining Up Guides.

is used for drilling the saddle bolt holes in the front ends.

An extension bar for supporting an air motor in drilling holes in the boiler at any angle is shown in Fig. 30. This

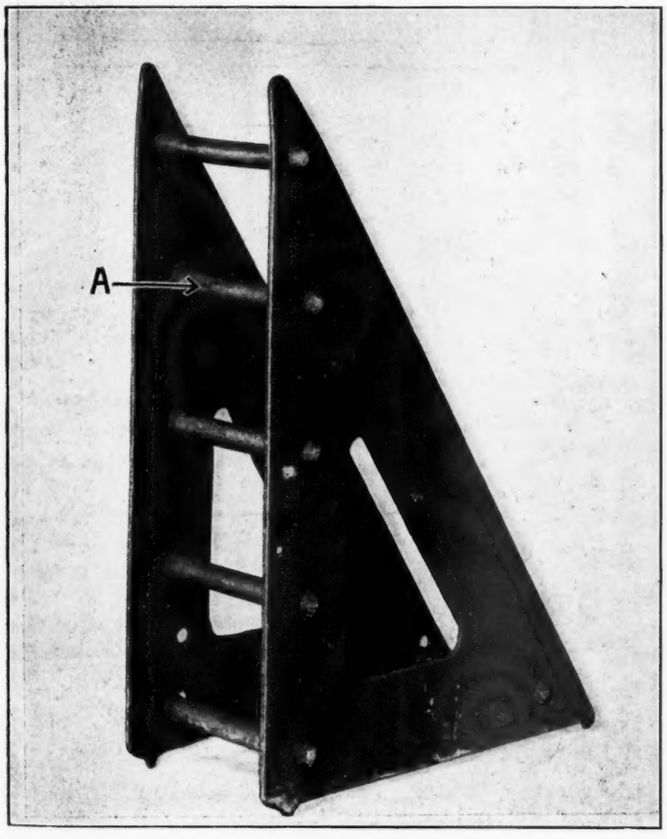


Fig. 35—Step Bracket for Putting Up Binders.

extension is adjustable and may be used in any size boiler.

GRINDING DRY PIPE JOINTS IN FRONT FLUE SHEET.

A special rigging for grinding the dry pipe into the front flue sheet is shown in Fig. 31. The device consists of an air motor A connected to a crank B, which oscillates the handle C attached to the dry pipe D, as shown in the photograph.

DRILLING HOLES IN STEAM PIPES.

A convenient apparatus for drilling holes in steam pipes is

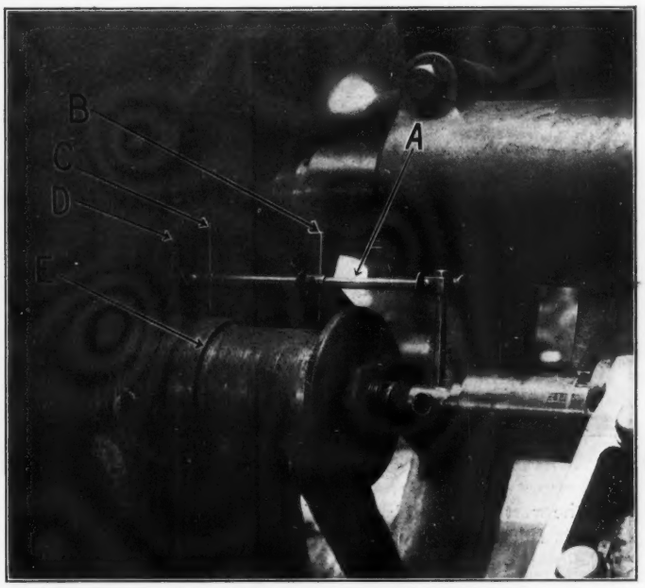


Fig. 36—Device for Locating Wear on Crank Pins.

shown in Fig. 32. The steam pipe is held rigidly with the face to be drilled in a horizontal position, by means of the two pairs of legs B and C, the upper parts of which are inserted through the two holes in the steam pipe and are keyed down to the frame D. At the top of D is a flat piece of iron E, which supports the top of the motor F. This support extends out sufficiently to allow the proper adjustment to the motor in locating the center of the hole to be drilled.

REAMING GUIDE BOLT HOLES.

A convenient apparatus for reaming guide bolt holes is

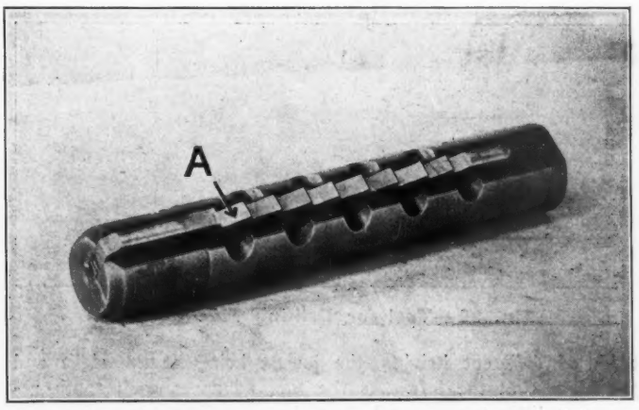


Fig. 37—Tool for Slotting Keyways.

shown in Fig. 33. The rigging may be quickly set up and is operated as follows: The reamer A is inserted in the guide bolt hole and the lever C, with a fulcrum at D in the adjustable jack E, is placed under the motor. Pressure is applied by the workman at the left, thus feeding the reamer into the hole as the workman on the right operates the motor.

ADJUSTABLE DEVICE FOR LINING UP GUIDES.

A kink used in lining up guides is shown in Fig. 34. It is constructed with the arms A notched at the ends to fit cylin-

ders whose diameters range from 16 in. to 21 in. It is placed at the front of the cylinder, as shown, with a similar but smaller device in the back cylinder head supporting the bar B. The bar is thus held in the center of the cylinder and is free to slide backward and forward, affording a means for lining up the guides.

STEP BRACKET FOR PUTTING UP BINIERS.

The step bracket in Fig. 35 is especially handy as a fulcrum for putting up shoes, wedges and binders. It is used

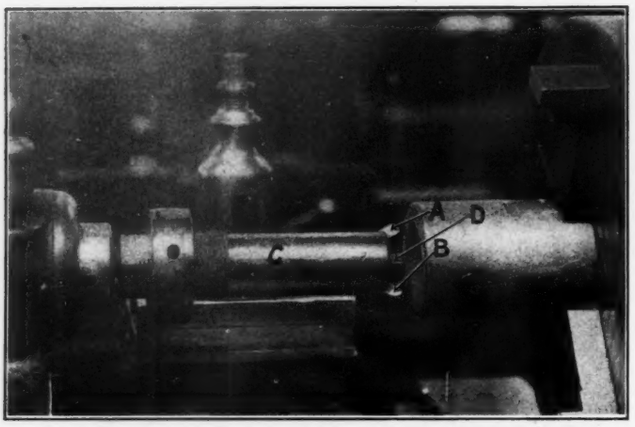


Fig. 38—Adjustable Boring Tool.

with the vertical side placed against the outside of the wheel. A bar is fulcrumed on one of the steps, as A, and with one end extending through the wheel and under the part to be raised. A sufficiently wide range is afforded by the five steps or points of support for putting up a binder.

INDICATOR OF WEAR ON CRANK PINS.

A special tool that readily indicates whether or not a crank pin is out of round is shown in Fig. 36. The device is fastened in the crank pin center of a quartering machine, with the three fingers B, C and D in contact with the pin, as shown. As it is revolved about the pin E the high and low spots are noted. The fingers are adjustable and may be used on crank pins of any size.

KEYWAY SLOTTING TOOL.

A tool for slotting keyways, used in a hydraulic press, is shown in Fig. 37. The cutting part consists of a number of

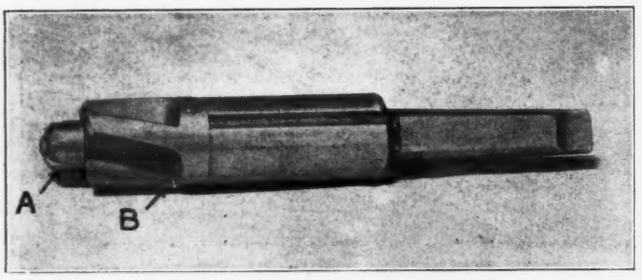


Fig. 39—Tool for Drilling Flue Sheets.

teeth of different heights, the lowest being at the right and the highest at the left. As the tool advances each tooth removes a little more metal than the preceding one. If necessary it may be used by driving it with a sledge.

ADJUSTABLE BORING TOOL.

An adjustable boring tool for use in the tail-stock of a lathe is shown in Fig. 38. It consists of two cutting tools, A and B, held in the chuck C by the nut D. The tools may readily be adjusted. The device is used principally in boring valve motion bushings.

DRILLING FLUE SHEETS.

A special tool for drilling flue sheets is shown in Fig. 39. The rose bit A is inserted in the small hole in the sheet and

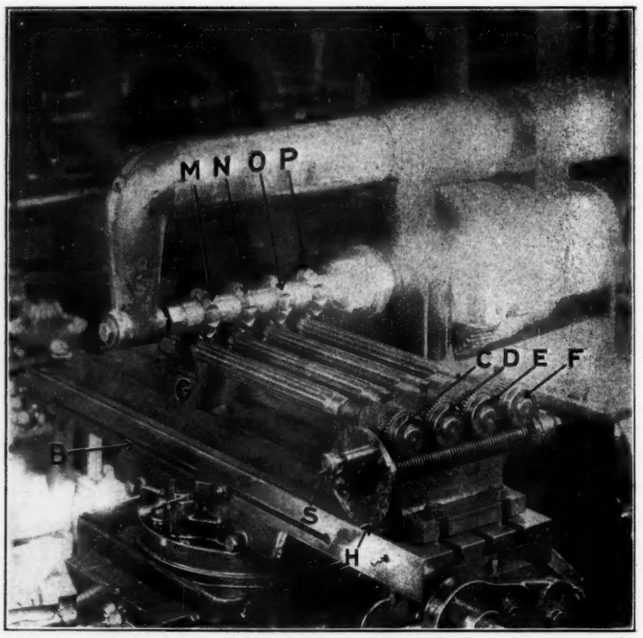


Fig. 40—Gang Chuck for Milling Four Reamers at One Time.

the drill B cuts the flue hole to the proper size. A hole can be drilled in from 32 to 35 seconds with this tool.

CHUCK FOR MILLING REAMERS.

A special gang chuck used for milling four reamers at the same time is shown in Fig. 40. It is bolted to the table B, and the reamers are inserted in the individual chucks C, D, E and F. The gang tail-stock is brought up, as shown, and the

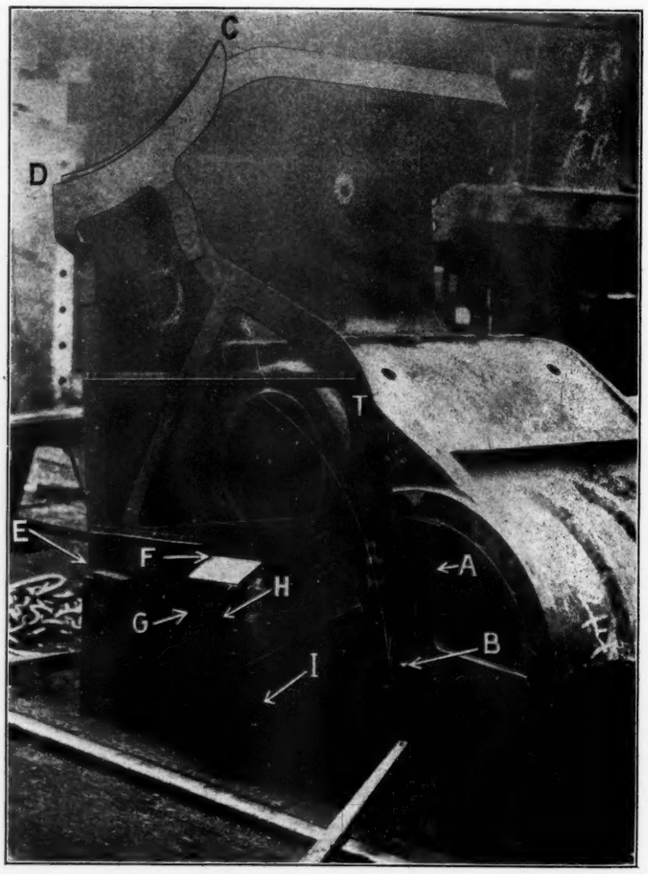


Fig. 41—Templet for Laying Out Cylinder Castings.

reamers are fed into the four cutters M, N, O and P. The chuck is equipped with a spacing head H, and all four reamers are spaced at the same time by the movement of the handle S.

TEMPLET FOR LAYING OUT CYLINDER CASTINGS.

A templet for laying out cylinder castings for slotting is shown in Fig. 41. The false center A is placed in the end of the cylinder, with the templet T pivoted to it at the center B. The templet is then adjusted so that there is stock outside of it at all points where the casting is to be machined. This being done,

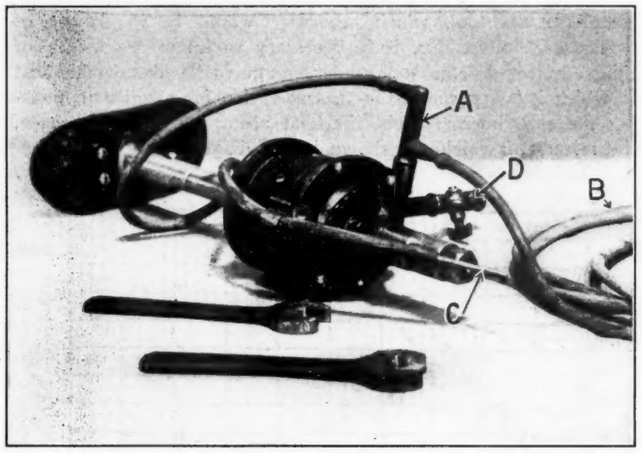


Fig. 42—Water Attachment for Breast Drill.

the cylinder casting is laid off according to the outline C, D, E, F, G, H and I.

WATER ATTACHMENT FOR BREAST DRILL.

A breast drill with an attachment for spraying water on the drill in drilling detector holes in staybolts is shown in Fig. 42. The rubber tubing B is placed in a water tank. The water is siphoned from the tank through this tube, the part A and out through the nozzle C. The air for operating the drill enters the motor through D. Some of it goes through the pipe A,

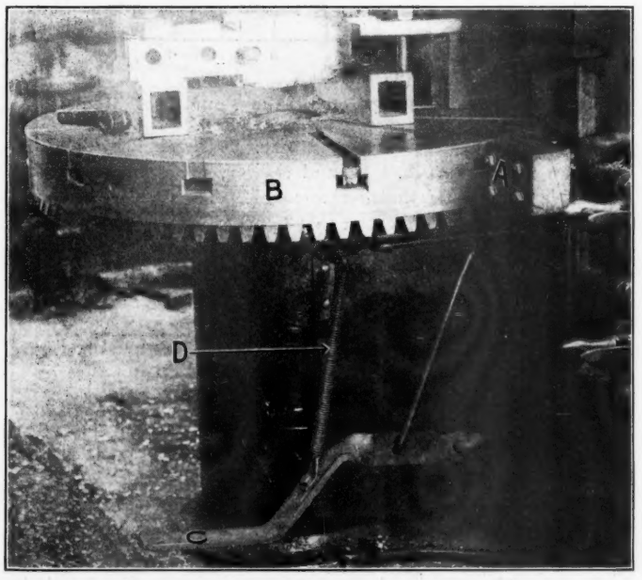


Fig. 43—Brake on Boring Mill.

rushing across the end of the tube B, thus causing a partial vacuum in B and siphoning the water through it.

BRAKE ON BORING MILL.

A considerable saving of time in stopping a boring mill may be accomplished by the use of a foot brake, as shown in Figs. 43 and 44. The brake A, consisting of a block of wood, is connected to the foot brake C. When pressure is placed on C the brake is forced against the table with sufficient force to

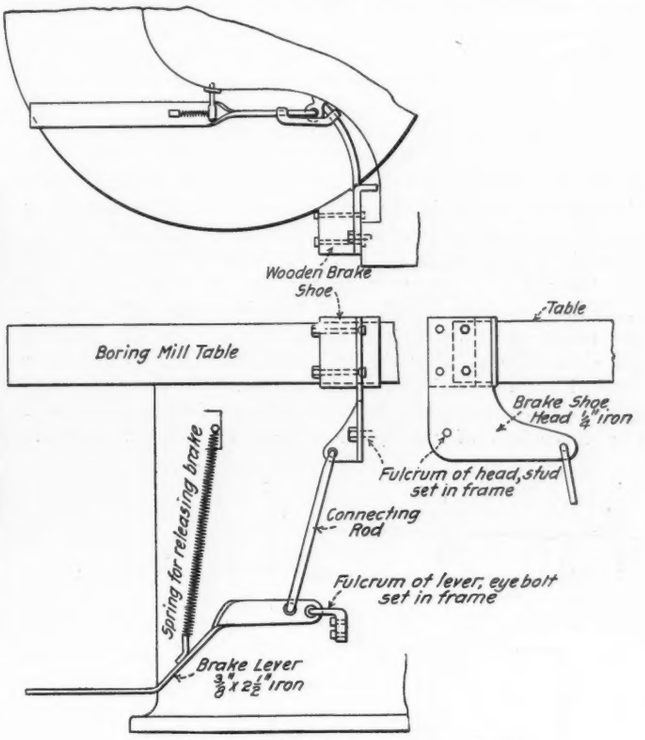

Wooden Brake Shoe
Table
Boring Mill Table
Brake Shoe Head ½" iron
Fulcrum of head, stud set in frame
Spring for releasing brake
Connecting Rod
Fulcrum of lever, eye bolt set in frame
Brake Lever ⅜" x 2½" iron

Fig. 44—Foot Brake on Boring Mill.

stop the machine immediately. When pressure is removed from C the spring D releases the pressure on the block.

HEAT TREATMENT OF HIGH-SPEED TOOLS.*

BY C. P. BERG.

The experiments described in this paper were undertaken in order to obtain the relation between temperature in tempering and the life of tools to a greater degree of exactness than heretofore known to the writer. The perfection of the electric furnace for high temperatures and its development into dimensions for such practical purposes as heat treatment of metal-cutting tools, in connection with the electric pyrometer for measuring these high temperatures, has made possible such investigations. The writer will confine himself exclusively to the attempt of solving the problem as it concerns the effect of various temperatures upon the life of high-speed tools.

The work may be said to consist of:

A. To establish a guide as to how rapidly the steel should be heated under the high heat treatment by a heat absorption test.

B. To determine at which degree of temperature in the heat treatment the maximum cutting efficiency occurs for a steel of a certain chemical composition.

C. To give the reasons for the relations found by these tests by metallurgical examinations and to illustrate them by photomicrographs.

Steels Used in Test.—Four prominent high-speed steels were selected to be experimented upon. These steels were marked A, B, C and D, and these marks will be retained in referring to the four series of specimens undergoing the various tests.

Tools Used in the Tests.—In order to eliminate the effect of forging upon the steels to be tested, straight tools for boring or inside turning, ground to shape and to standard angles in a grinder, were decided upon. Steel bars of ⅜ in. by 1½ in.

*Abstract of a paper presented at the June meeting of the Western Society of Engineers.

size were cut from the four steels, to be made into tools for roughing cuts in boring cylinders to 4½ in. diameter. The tools were treated and ground with a cutting edge on both ends and to cutting angles as shown in the accompanying sketch, Fig. 1.

Specimens Used for Physical Tests.—Cylinders made from cast iron, of a chemical composition producing exceptionally hard castings, were provided for the tests. In order to insure equality, the greatest care was taken in preparing the molds for the castings, and all were poured from the same heat. In view of the fact that the life of a tool decreases with the increase of combined carbon in the castings on which it is used, and again, that the amount of combined carbon is dependent upon the rapidity with which the cast iron is cooled after pouring it into the mold, it became necessary to find some method by which these castings could be cooled in the same length of time. The molds were therefore specially arranged for this purpose and eight minutes after the iron was poured the cores were removed and the castings cooled in water. This gave the castings as nearly as possible the same amount of combined carbon. The dimensions of the cylinders were as follows: Outside

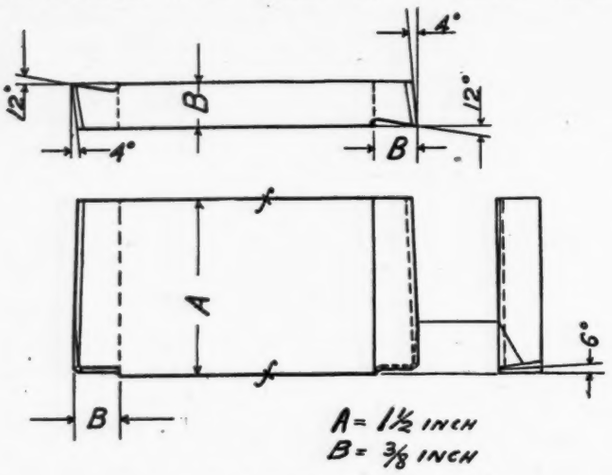


Fig. 1—Boring Tool Used in Tests.

diameter, 8 in.; length, 8 in.; and diameter of core, 4 in., leaving ½ in. of metal to be removed by the double end tools to be tested, or, in other words, providing for ¼-in. depth of cut for each end of the tool.

Heat Treatment of the Tools.—The temperatures used in the heat treatment of tools have heretofore generally been measured in practice by the terms: cherry red, bright yellow, white, etc. These measurements of heat were probably as correct as any other in connection with the old-time method of tempering tools in the blacksmith forge, where no accurate control of the heat could be obtained. Admitting that there are experts in this line, who are able to guess temperatures very closely by the color of the heated steel, the writer has heard differences of opinions, when the limit line was to be drawn between white and bright yellow, etc. With the modern electric furnace, its perfect control, evenly distributed heat preventing burning of the steel, and the thermo-electric pyrometer for measuring temperatures, the science of treating metal-cutting tools has taken a long step forward.

The instruments as used for the experimental tools were: A muffle furnace for preheating the steel slowly up to 1,400 deg. F., prior to transferring it to the tube furnace to be subjected to the high heat treatment. The muffle furnace was of the wire resistance type constructed for temperatures up to 1,800 deg. F. The tube chamber design of furnace, where the experimental tools were subjected to the high-heat treatment, was constructed for temperatures up to 2,600 deg. F.

The current for both of these furnaces was controlled on a switchboard which carried the thermo-electric pyrometer, which was connected with the thermo-couples by the switch in the center of the board, this rendering possible the reading of temperatures in several furnaces on the one instrument by turning the switch. To insure accuracy the thermo-couples used were calibrated before and after the readings made on the temperatures of the test specimens. The calibrating consisted in taking a reading on water at the boiling point (212 deg. F.), on aluminum at the melting point (1,215 deg. F.), and on copper at the melting point (1,949 deg. F.). In giving high-speed tools the high heat treatment, the temperature should be raised rapidly to the desired degree for quenching, but enough time should be allowed for the heat to penetrate thoroughly to the center of the tool, which otherwise would be in danger of cracking. To do this, it is necessary to know the length of time required by the tool under treatment to absorb the heat to which it is subjected. To ascertain this for a guide in treating the experimental tools, the heat absorption test was made, the results of which are shown in the diagram, Fig. 2.

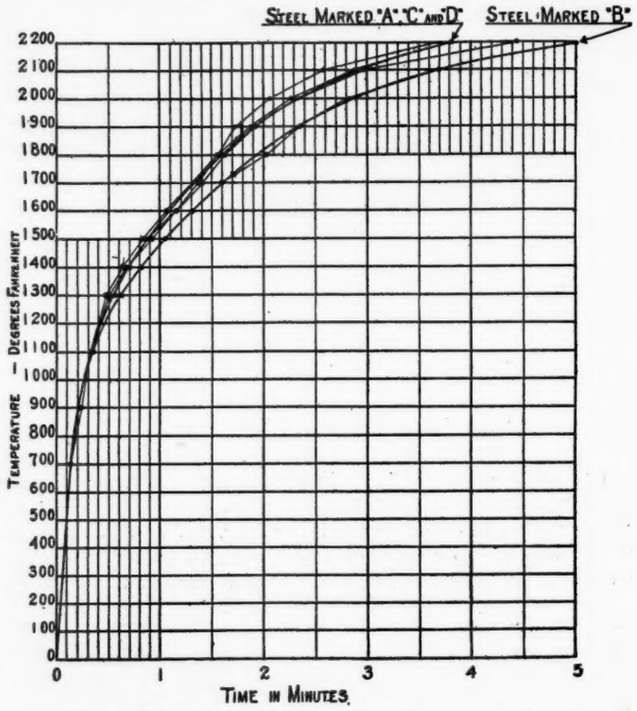


Fig. 2—Heat Absorption of the Four Tool Steels.

Four pieces of steel of equal size, ⅜ by 1½ by 1½ in., one from each end of A, B, C and D, were prepared with a hole to receive the end of the thermo-couple. The furnace was run up to 2,200 deg. F. and kept at that temperature. The test pieces were placed in the furnace individually and time observations were taken on the increasing temperature of the steel. Noting the uniformity of the curves in the diagram, Fig. 2, it will be seen that the molecular change in the steel up to 2,200 deg. F. did not at any point disturb the evenly increasing temperature of the specimen. As will appear later, it was found that some of these steels are treated with the best results at 2,150 deg. F. The molecular change evidently is not violent enough and quick enough to stop the increase of temperature in the steel, at least it could not be observed by the instruments used.

From other tests made on heat absorption with various sizes of steel, it appears that the time for the absorption of heat increases very nearly in proportion to the thickness of the steel. Thus, a piece of steel ¾ in. thick requires twice as long a time as is shown by the diagram in Fig. 2, which would be 6.6 minutes for a temperature of 2,150 deg. F. for any one of the A, C and D steels.

Photographs of fractures were shown of specimens from steel A, which had been heated to 2,150 deg. F., but which were left in the furnace a certain length of time after reaching this temperature before quenching in oil at 100 deg. F. Comparing these

fractures with the ones from the experimental tools and the results from the physical tests of the latter, strongly indicates the necessity of careful observation in the matter of time for the tool to remain in the furnace to become thoroughly and uniformly heated.

A hardness test on these specimens performed with a scleroscope gave the results shown in the following table:

TABLE II.

Specimen.	Length of time left in furnace.	Hardness by scleroscope.
1	2 min.	80
2	4 "	79
3	6 "	78
4	8 "	68
5	10 "	79
6	12 "	70

Based upon the above results, the heat treatment of the experimental tools was undertaken. The specimens were marked, preheated to 1,400 deg. F., and from this temperature heated to the various degrees of high heat, as shown in Table III. At the temperatures indicated in the table, the specimens were quenched in oil, which was kept constant at 100 deg. F. For convenient comparison, the results of hardness tests with the scleroscope upon the treated specimens are also shown.

TABLE III.

	Tempt., Fahr.	Hardness.		Tempt., Fahr.	Hardness.
A— 1	1,850	78	C—21	1,950	78
2	1,900	81	22	2,050	80
3	1,950	76	23	2,100	80
4	2,000	78	24	2,150	83
5	2,050	81	25	2,200	80
6	2,100	82	26	2,250	75
7	2,150	83	27	2,300	73
8	2,200	81	28	2,350	..
9	2,250	77	29	2,325	71
10	2,250	77	30	2,350	68
0	2,300	74	D—31	1,950	70
B—11	1,850	78	32	2,050	75
12	1,900	74	33	2,100	76
13	1,950	75	34	2,150	81
14	2,000	77	35	2,200	79
15	2,050	83	36	2,250	83
16	2,100	83	37	2,300	86
17	2,150	82	38	2,350	86
18	2,200	79	39	2,300	86
19	2,250	78	40	2,400	84
20	1,750	68			

Specimen 0 of series A softened and caved in on one side. Specimen 28 of series C softened so the free end (not supported by the tongs) tore off in removing it from the furnace. Specimen 30 was taken to replace the broken one, and special precautions were made for its removal from the furnace, and it was quenched without mishaps. The specimens receiving the maximum heat all fused at the ends and some were considerably softened.

Physical Tests.—The life or durability of these tools appears to vary a good deal. Being ground into tools the specimens were put to work under equal conditions on the castings. A 34-in. vertical boring mill was selected for the test, in order that the

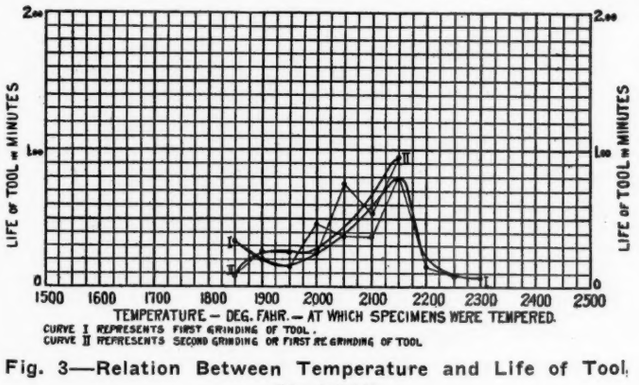

LIFE OF TOOL IN MINUTES
2.00
1.00
0
1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500
TEMPERATURE — DEG. FAHR. — AT WHICH SPECIMENS WERE TEMPERED.
CURVE I REPRESENTS FIRST GRINDING OF TOOL.
CURVE II REPRESENTS SECOND GRINDING OR FIRST RE GRINDING OF TOOL

Fig. 3—Relation Between Temperature and Life of Tool, Steel "A"

chips should clear away from the tool easily. The ends of the cylinders were faced, to eliminate the scraping of the scale by the experimental tools.

The results from the tests run on the specimens from steel A are plotted in the diagram, Fig. 3. The specimens quenched at a temperature above 2,150 deg. F., failed almost immediately and broke. The second curve (II), which represents the second grinding of the tool, shows a slight increase in durability. This indicates the effect a second heat treatment (drawing the temper of the tool after the high heat treatment) has on the tool, which effect can be gotten as readily by running the tool at high cutting speeds until it fails, and having it reground, as by drawing the temper in the furnace. However, this method is less accurate, as there is no means of determining the heat thus developed under the cutting action, at the present time. The cutting speed, 80 ft.

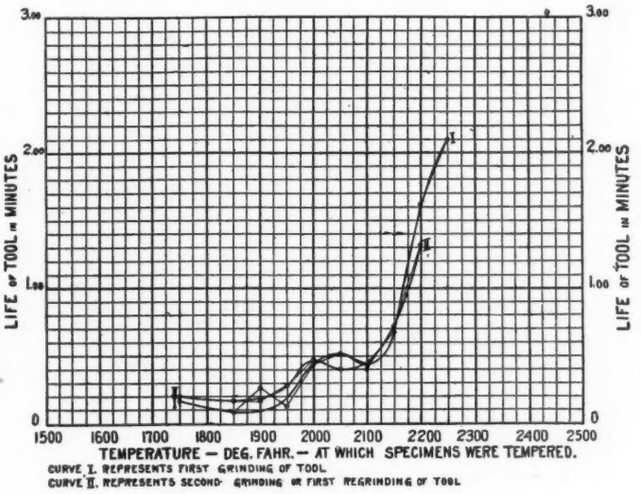

LIFE OF TOOL IN MINUTES
3.00
2.00
1.00
0
1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500
TEMPERATURE — DEG. FAHR. — AT WHICH SPECIMENS WERE TEMPERED.
CURVE I. REPRESENTS FIRST GRINDING OF TOOL
CURVE II. REPRESENTS SECOND GRINDING OR FIRST REGRINDING OF TOOL

Fig. 4—Relation Between Temperature and Life of Tool, Steel "B."

per minute, the thickness of the shaving or feed per revolution, 0.0339 in., and depth of cut, ¼ in., at each end of the tool, were kept constant for all specimens and for both grindings.

Results from the tests run on the specimens of steel B are plotted in the diagram, Fig. 4. The curves do not present a great deal of uniformity at the low temperatures, but improve and become more distinct as the temperature increases. The specimen receiving the highest heat showed the maximum durability, but it failed very suddenly and broke into several pieces. The fractures gave evidence of brittleness. Practically no differ-

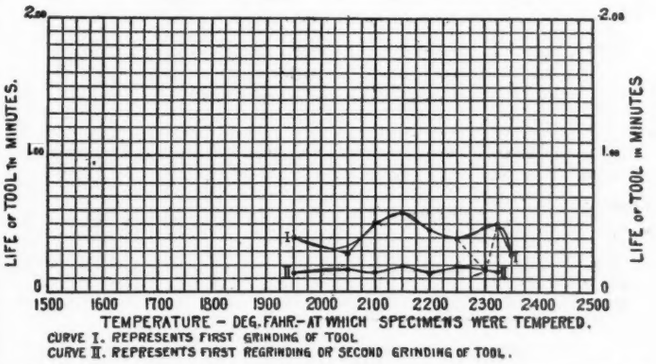

LIFE OF TOOL IN MINUTES.
2.00
1.00
0
1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500
TEMPERATURE — DEG. FAHR.— AT WHICH SPECIMENS WERE TEMPERED.
CURVE I. REPRESENTS FIRST GRINDING OF TOOL
CURVE II. REPRESENTS FIRST REGRINDING OR SECOND GRINDING OF TOOL.

Fig. 5—Relation Between Temperature and Life of Tool Steel "C."

ence in durability appears between the first and second grinding of the tool.

The results from the tests run on the specimens of steel C are plotted in the diagram, Fig. 5. The cutting speeds were evidently too high for this grade of steel. The durability being very low at all points, the variations are not distinct. However, it will be seen that the durability attains its maximum at 2,150 deg. F. in Curve I, representing the first grinding of the tool. The dotted lines show that the specimen which was quenched at 2,300 deg. F., failed and broke almost immediately after starting.

Curve II, representing the second grinding of the tool, does not show any variations whatever, and the difference between this and first grinding is negative. Both these occurrences are directly due to an increase in cutting speed of 20 ft. per minute

for the specimens on second grinding. The cutting speed, 80 ft. per minute, for first grinding, and 100 ft. per minute for second grinding, the thickness of shaving or feed per revolution, 0.0339 in., and depth of cut, ¼ in. at each end of the tool, were kept constant for all specimens.

Results from the tests run on the specimens of steel D are shown by the diagram in Fig. 6. In this diagram it may be noted

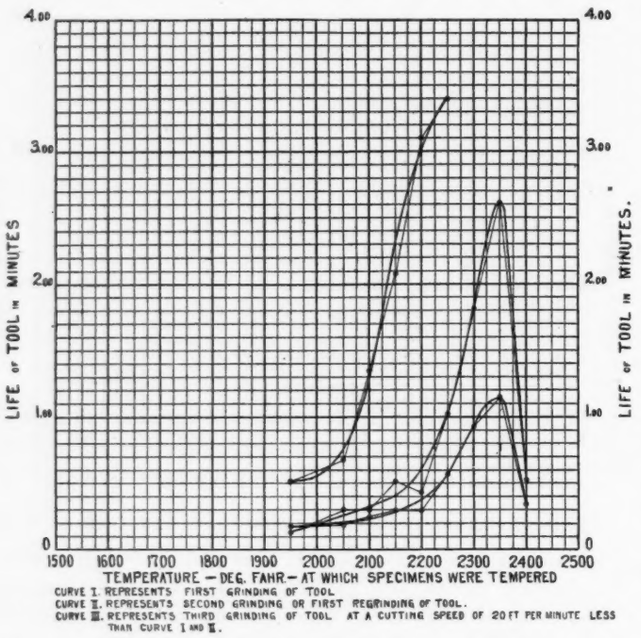

LIFE OF TOOL IN MINUTES
4.00
3.00
2.00
1.00
0
1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500
TEMPERATURE — DEG. FAHR — AT WHICH SPECIMENS WERE TEMPERED
CURVE I. REPRESENTS FIRST GRINDING OF TOOL.
CURVE II. REPRESENTS SECOND GRINDING OR FIRST REGRINDING OF TOOL.
CURVE III. REPRESENTS THIRD GRINDING OF TOOL AT A CUTTING SPEED OF 20 FT PER MINUTE LESS THAN CURVE I AND II.

Fig. 6—Relation Between Temperature and Life of Tool Steel "D."

that part of the specimens were subjected to a test after being ground a third time. All three curves (I, II and III) show the variations very distinctly, and of exceptionally high durability, with the attained maximum at the quenching temperature of

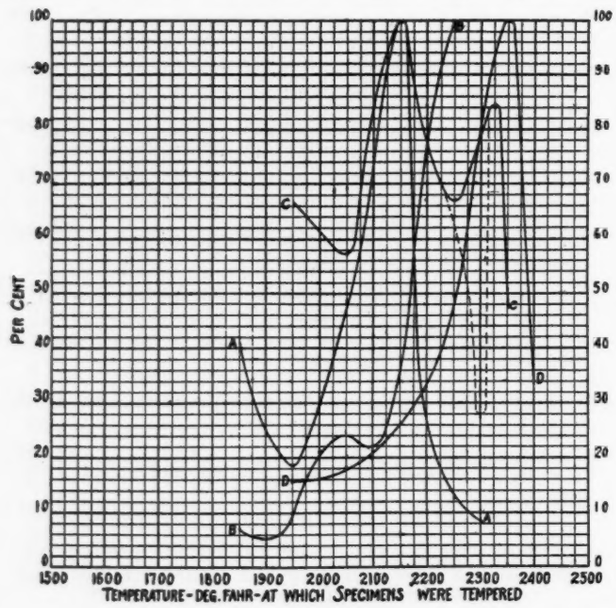


Fig. 7—Relation Between Temperature and Life of Tool in Percentage for the Four Steels.

2,350 deg. F. for both the first and the second grinding. The specimen quenched at 2,400 deg. F. broke on the second grinding after failing in the length of time (0.52 minute) as shown in the diagram. Only part of the specimens were run on the third grinding, simply for the reason that the time for boring one cylinder would not be sufficient for the tool to fail at a cutting speed of 80 ft. per minute. Cutting on more than one cylinder with the same tool would cool the cutting edge of the tool while changing, and the result could not be considered. The cutting speed, 100 ft. per minute for first and second grinding, and 80 ft. per minute for third grinding, the thickness of shaving or feed per revolution, 0.0339 in., and the depth of cut, ¼ in. at each end of the tool, were kept constant for all specimens.

In Fig. 7 is shown a diagram giving by percentage the relation between temperature and life of tool, of the four series of specimens. The temperature forms the base of the diagram, and the ordinate is made into a per cent. scale. The maximum life or durability of the tool is taken as the unit output at 100 per cent., and the durability in percentage of the maximum can be read from the curves for any temperature used.

Taking the results of these experiments as a whole, the general shop rule for treating a high speed tool—"Heat it to a white heat and quench it"—does have its shortcomings, because a variation of 50 deg. F. cannot be determined by the eye.

A poorly treated tool decreases the shop production for the manufacturer, who allows it inside his establishment. It increases the bill of the customer, who pays for the tool and the work spent on it. When the works manager comes through the shop and inquires about the tools, the workman naturally testifies the tool steel to be of inferior quality, which, as we have seen, may not be the case, but this tool steel maker has to find a new market for his stock of steel. In short, it is waste of energy and waste of capital.

THE BREWSTER SHOPS OF THE WHEELING & LAKE ERIE.

The main line of the Wheeling & Lake Erie, between Orrville and Harmon, Ohio, formerly passed through Massillon, but the more direct route which was finished last year is some distance south, and new classification yards, a locomotive terminal and large locomotive shops have been located on the new cut-off at Brewster, Ohio, which is about nine miles southeast of Massillon. Practically all of the freight on the Gould lines in western Pennsylvania, West Virginia and eastern Ohio over the Wabash-Pittsburgh Terminal and the Wheeling & Lake Erie will be handled through the Brewster yards, making it an important point. It was decided to abandon the shops at Canton and Norwalk, Ohio, and concentrate the work of locomotive repairs at Brewster. The yards and locomotive terminal were completed and placed in operation about the first of the year, but the shops will not be finished until midsummer.

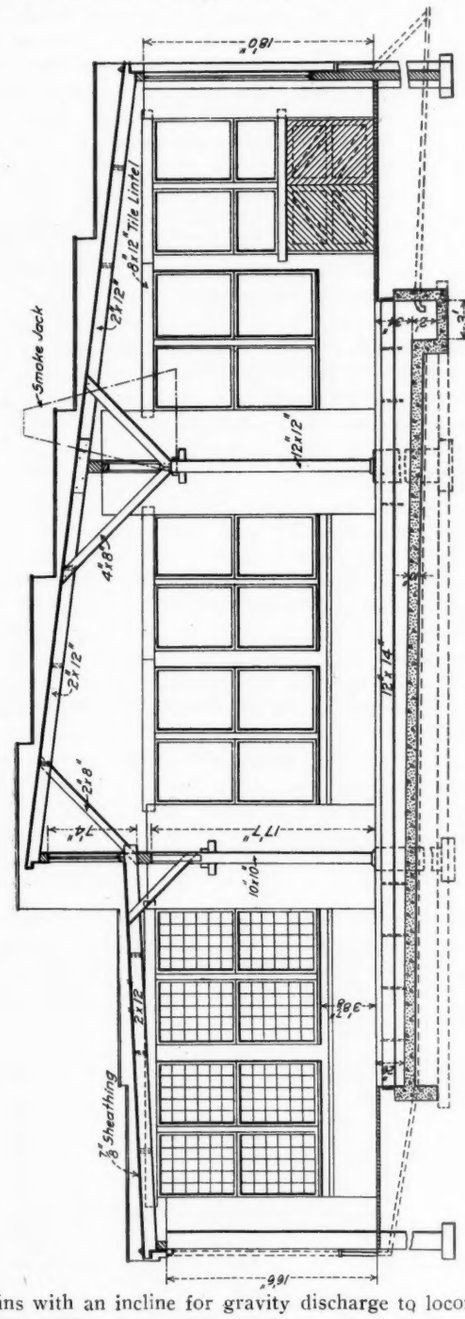
The general arrangement and design of the repair shop facilities, with respect to the distribution and handling of the locomotives and of all labor and material involved in the repair and manufacturing work, was planned under the direction of J. E. Muhlfeld, railway expert. The shop buildings were designed and are being built by Westinghouse, Church, Kerr & Co., and, together with the mechanical details, have been worked out by V. Z. Caracristi, consulting engineer for the Wheeling & Lake Erie.

Engine House.—The engine house and locomotive terminal layout was designed by the chief engineer, H. T. Douglas, Jr. The engine house is constructed principally of vitrified tiles, 8 x 8 x 16 in., and contains 26 stalls. The width of the building is 90 ft., the space between the wall and the turntable pit is 62 ft. 5 in., and the diameter of the turntable is 90 ft. There is one large drop pit for driving wheels under two tracks, and two smaller ones for trucks at the ends of two other tracks. The cross-section shows the flat wooden roof timbers supported at the central portion by two wooden posts placed 30 ft. centers. At the post nearest the inner circle the roof is raised about 7 ft. for light and ventilation and is provided with large hinged glazed sash. The height at this point is about 26 ft., while that at the entrance is only 17 ft. and at the rear wall 18 ft.

LOCOMOTIVE TERMINAL.

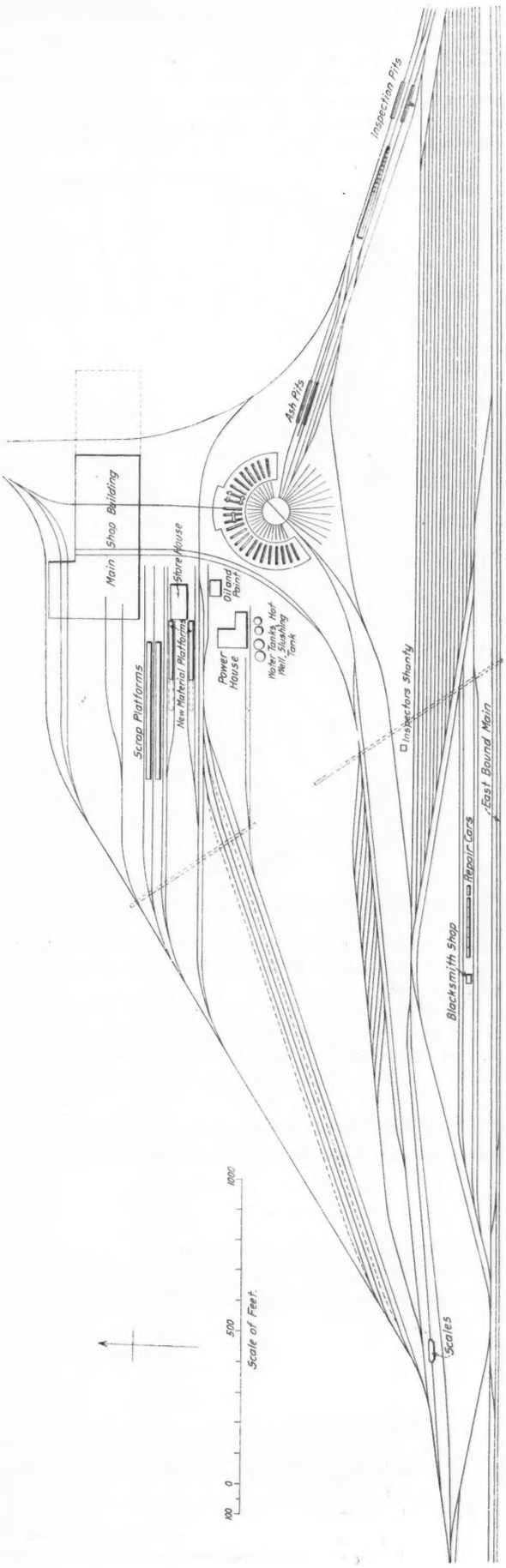
Inspection Pits.—In the tracks approaching the engine house there are two inspection pits, each 130 ft. long, one on each side of the track leading to the coal wharf incline. A plan and sections of these tracks and the subway connecting them is shown in one of the illustrations. The walls of the pits are of concrete and the tracks are carried over the subway on I beams.

Coaling Station.—The coal wharf is a wooden structure with an incline for elevating hopper cars by an electric hoist. This structure is 38 ft. 3 in. high to the base of the rail. There are



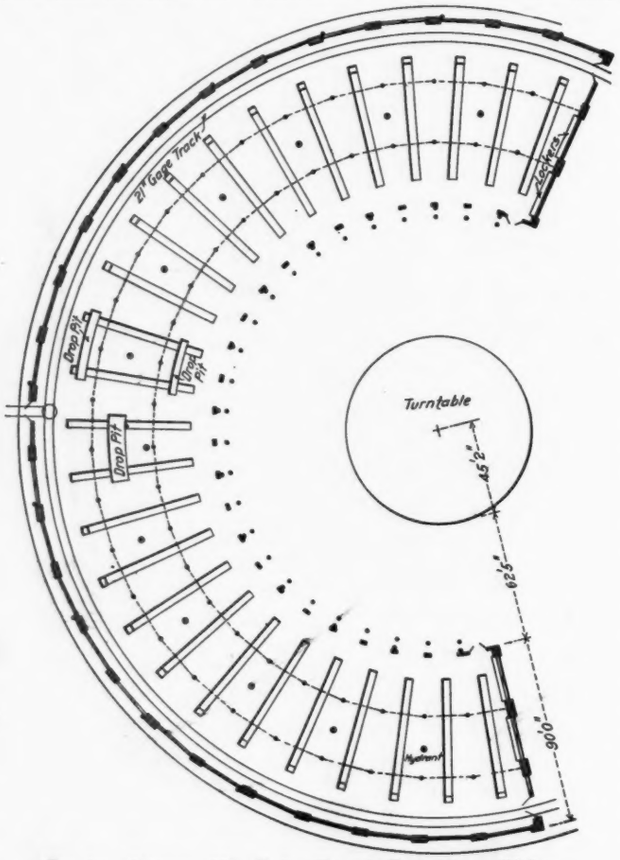
Section Through Engine House. W. & L. E., at Brewster, Ohio.

five bins with an incline for gravity discharge to locomotives on each side. The gate and spout for conducting the coal to the tender is the Kattenbach and Griese design. Beyond the coal bins in the same structure there are three bins for the storage of wet sand, having a total capacity of 1,122 tons. One of these bins is shown in section, and it will be seen that they discharge sand directly into large stove driers placed under the center of the hopper bottom of the bin. As the sand is dried it is elevated by compressed air to another bin at the end of the wharf, whence it flows by gravity through hinged spouts to the sand box on the locomotive.



General Plan of the Wheeling & Lake Erie Shops at Brewster, Ohio.

Ash Pit.—There are three tracks leading to the turntable and under two of them and near the roundhouse is a large ash pit with a depressed track for cinder cars. This ash pit is shown in section. The engine tracks at the pit have one rail supported directly on the concrete pier and the other on cast iron columns spaced 4 ft. 2¾ in. centers. The ash pits are 3 ft. deep and are lined with vitrified brick. There is a shelf 3 ft. 6 in. wide covered



Engine House, W. & L. E., at Brewster, Ohio.

with ⅛-in. steel plate and supported on brackets between the pit and the cinder car for the workmen who shovel the ashes from the pit to the car.

Boiler Washing System.—The plant for boiler washing is located in a wing of the power house and four pipes, each about 200 ft. long, lead from it to the roundhouse. There is one 6-in. blowoff line, one 5-in. washout line, one 5-in. filling line and one 1-in. filling circulating line. The National Boiler Washing system is used.

SHOP PLANT.

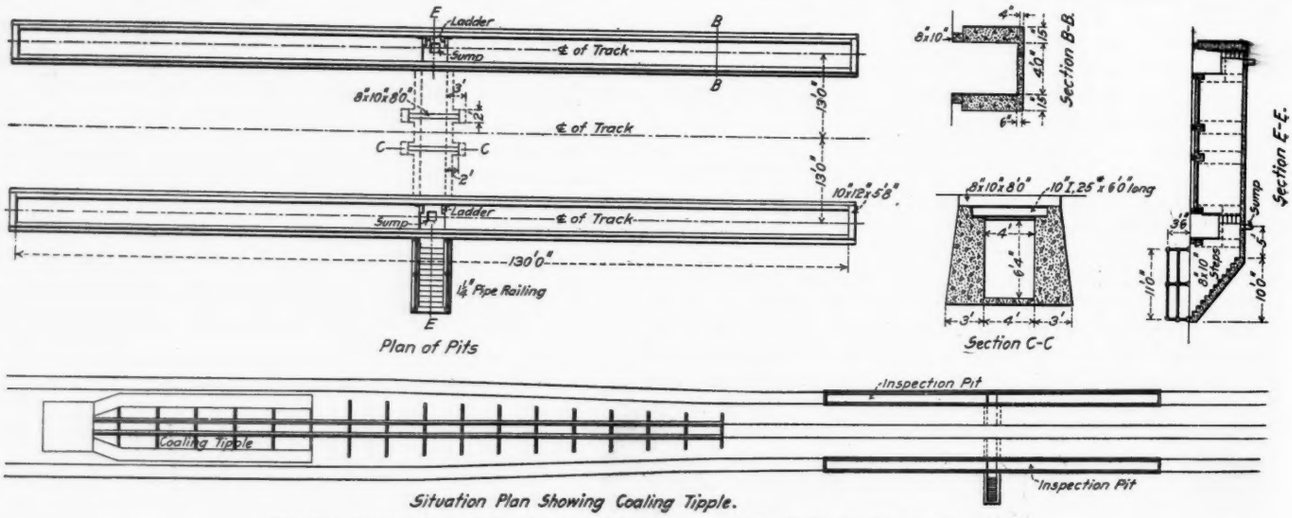
The shop structures consist of a large locomotive shop, a power house, storehouse and an oil and paint store, all of brick on concrete foundations.

Locomotive Shop.—The locomotive building includes under one roof the machine and erecting shop, boiler shop, tender shop, smith shop and brass foundry. This structure is 227 ft. 10 in. wide and 528 ft. long, with a wing at one end 88 ft. 3 in. x 201 ft. 6 in., making the extreme width at that end 316 ft. 1 in. The drawing of the cross-section is through the widest portion; it will be seen that the side walls are 41 ft. 8 in. high, and the bays at these points are 31 ft. 11½ in. wide, with galleries. The clear height on the first story is 17 ft. 8½ in. and on the second story 18 ft. At the left of the main center is the tender shop with a width of 58 ft. 1 in. and a clear height of 41 ft. 4 in. This bay is provided with a 30-ton electric crane. Next is the erecting shop, 68 ft. wide, and with a clear height of 46 ft. There is one 10-ton crane on the lower level, and the columns provide for a future crane of 120 tons capacity.

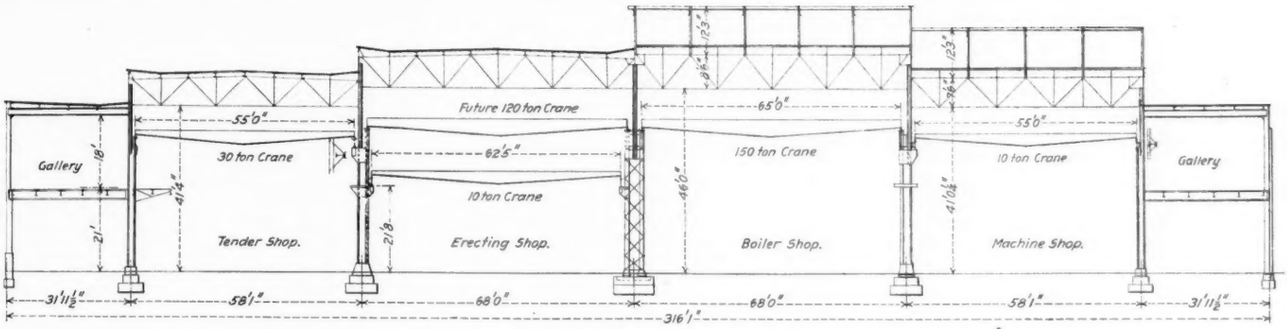
The boiler shop bay is 68 ft. wide, 46 ft. clear height and is provided with one 10-ton electric crane and one 150-ton electric crane, which handles locomotives in the transfer bay. The heavy machine bay is 58 ft. 1 in. wide, 41 ft. ¼ in. clear height and is provided with a 10-ton electric crane. Next to this is the gallery side bay, already referred to, which contains many of the lighter machine tools.

The location of the machine tools, erecting pits, furnaces, forges, etc., is shown on the plan. There are 18 live erecting pits for locomotives under repairs. In line with these in another bay is a set of pits on which the locomotives are stripped and removed from the wheels for transfer to the erecting shop, and also mounted on the wheels and finished after transfer from the erecting shop. By this means the building side-wall, transfer table and pit, and like waste construction and uncovered space, made necessary by the usual transfer table arrangement, is eliminated and a covered overhead traveling crane and floor space is substituted which permits of segregating the stripping, wheel, truck, finishing, pipe and paint work from the erecting shop work proper, thereby increasing the capacity of the latter and eliminating avoidable lost movements of labor and material by concentration of the supervising and working forces under one roof.

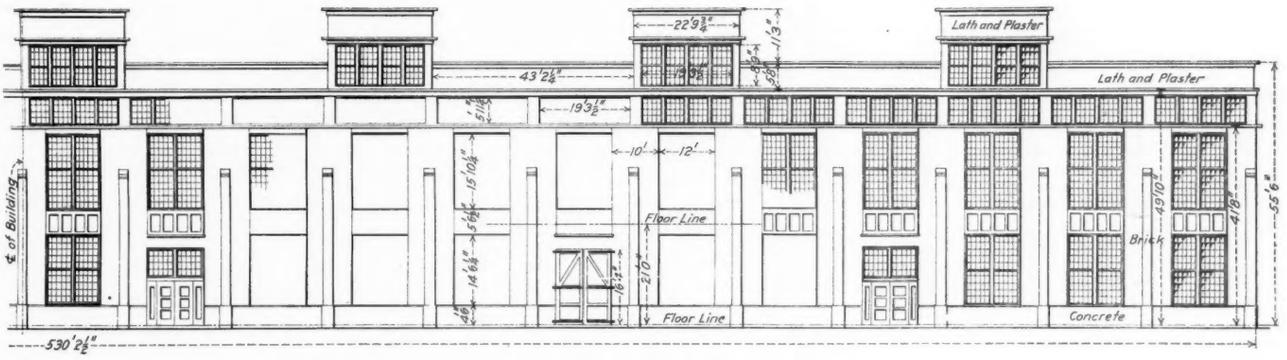
It is not intended to lift the locomotives over others as is usually done where transfer tracks are used in erecting shops without a transfer table. The engines are taken in to one of the inner or driving wheel tracks and lifted from the



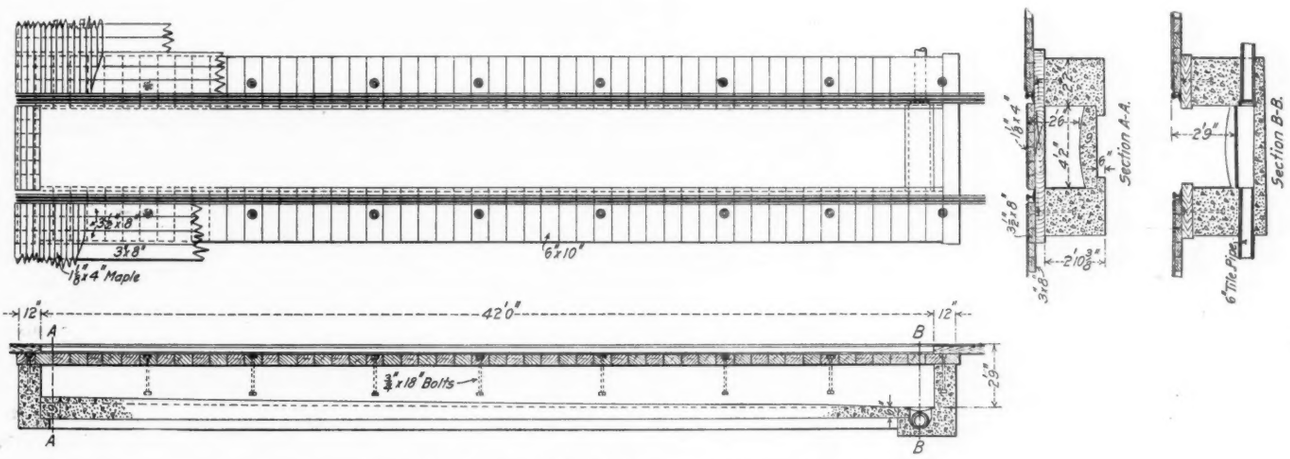
Engine Inspection Pits of the Wheeling & Lake Erie at Brewster, Ohio.



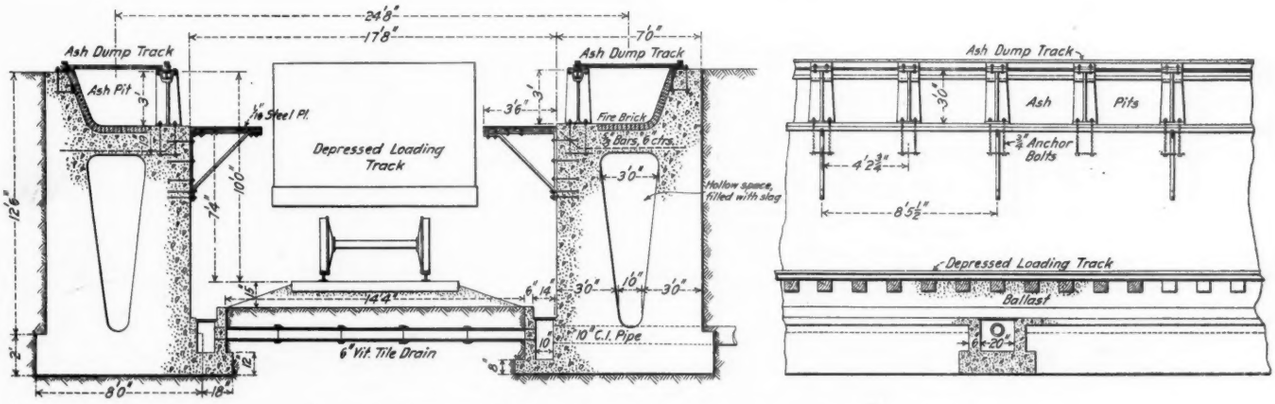
Cross Section Through Locomotive Shop at Brewster, Ohio, W. & L. E.



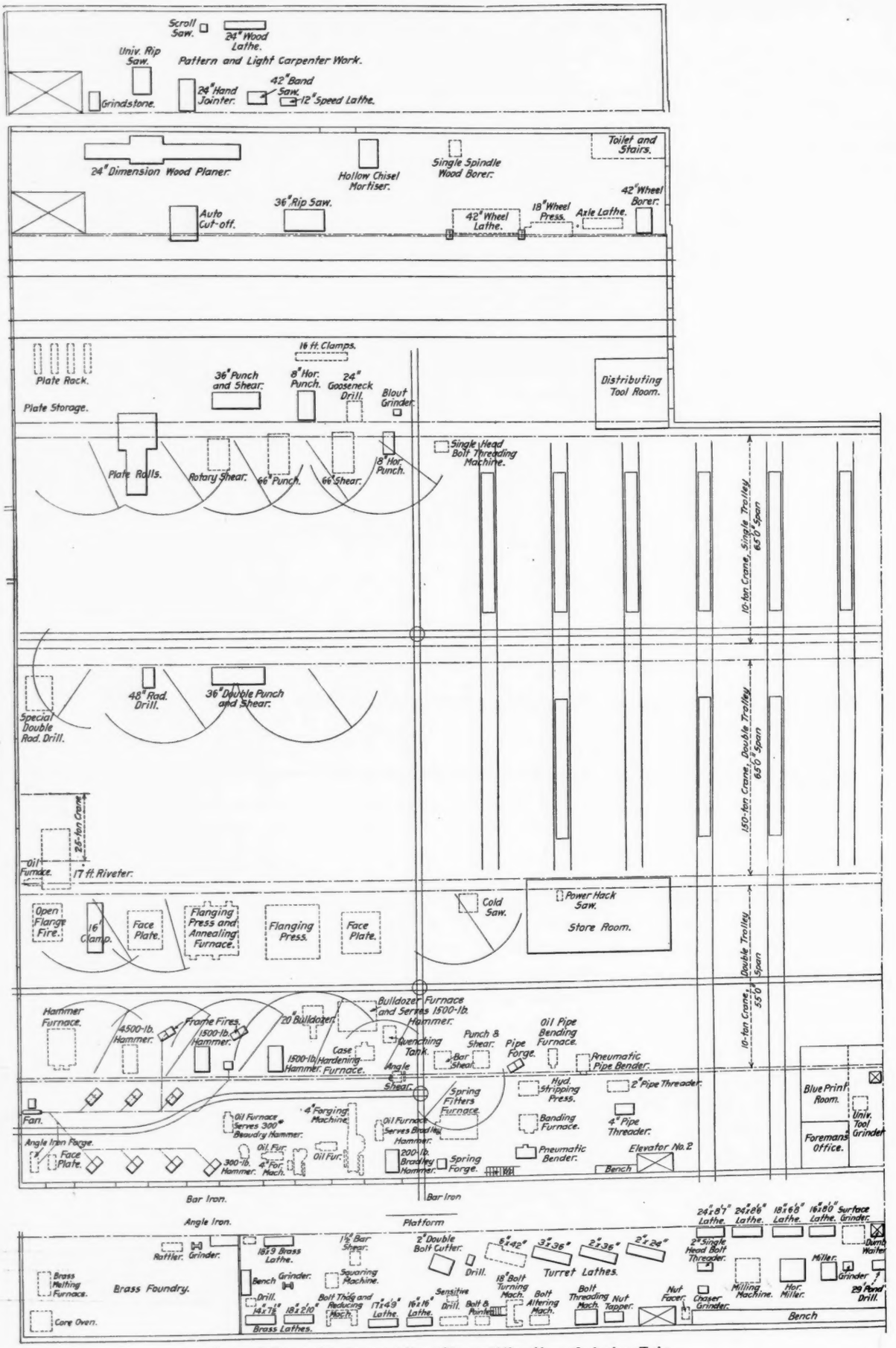
Partial Side Elevation of Locomotive Shop.



Construction of Pits in the Erecting Shop, Brewster Shops.



Ash Pit Construction, Wheeling & Lake Erie, Brewster, Ohio.



Plan of Brewster Locomotive Shop, Wheeling & Lake Erie.

wheels and placed on shop trucks, on which they are taken to the regular erecting pit. In this way the locomotive need only be hoisted high enough to clear the driving wheels for longitudinal transfer and the height of the shop is 4 to 5 ft. less than where the locomotive is lifted entirely over others. It will be noticed that the roofs over each bay are very nearly flat and there is only enough depression to provide proper drainage to the down spouts which are inside the walls in all cases. In the view of the south elevation of the locomotive shop it will be noticed that there are transverse upper decks with sash 8 ft. 9 in. high; these are 22 ft. 9¾ in. wide and are spaced 43 ft. 2¼ in. apart. They provide an abundance of light and ventiliation and some of them are utilized for the room required for the large hot blast fans used in the heating system. The roof arrangement for light and ventilation is somewhat similar to that which has been employed in the large steel buildings for steel freight car shops.

The floor of the shop consists of a layer of broken stone 6 in. thick covered with tarred sand 1 in. thick. On this is laid 3-in. pine flooring with a final covering of maple 1⅛ x 4 in. thick laid at right angles with the pine. The floor support at the erecting pits is worthy of notice, as it is intended to overcome the objection to most wood floors, which sink under the pressure of the jacks used about the engines. In this design, which is here illustrated, short ties 9 in. thick and 2 ft. 6 in. long are bolted to the top of the concrete pit wall projecting slightly at each side. These ties are laid close together, forming a continuous support for the pit rail as well as a solid support for the floor some distance out from the rail.

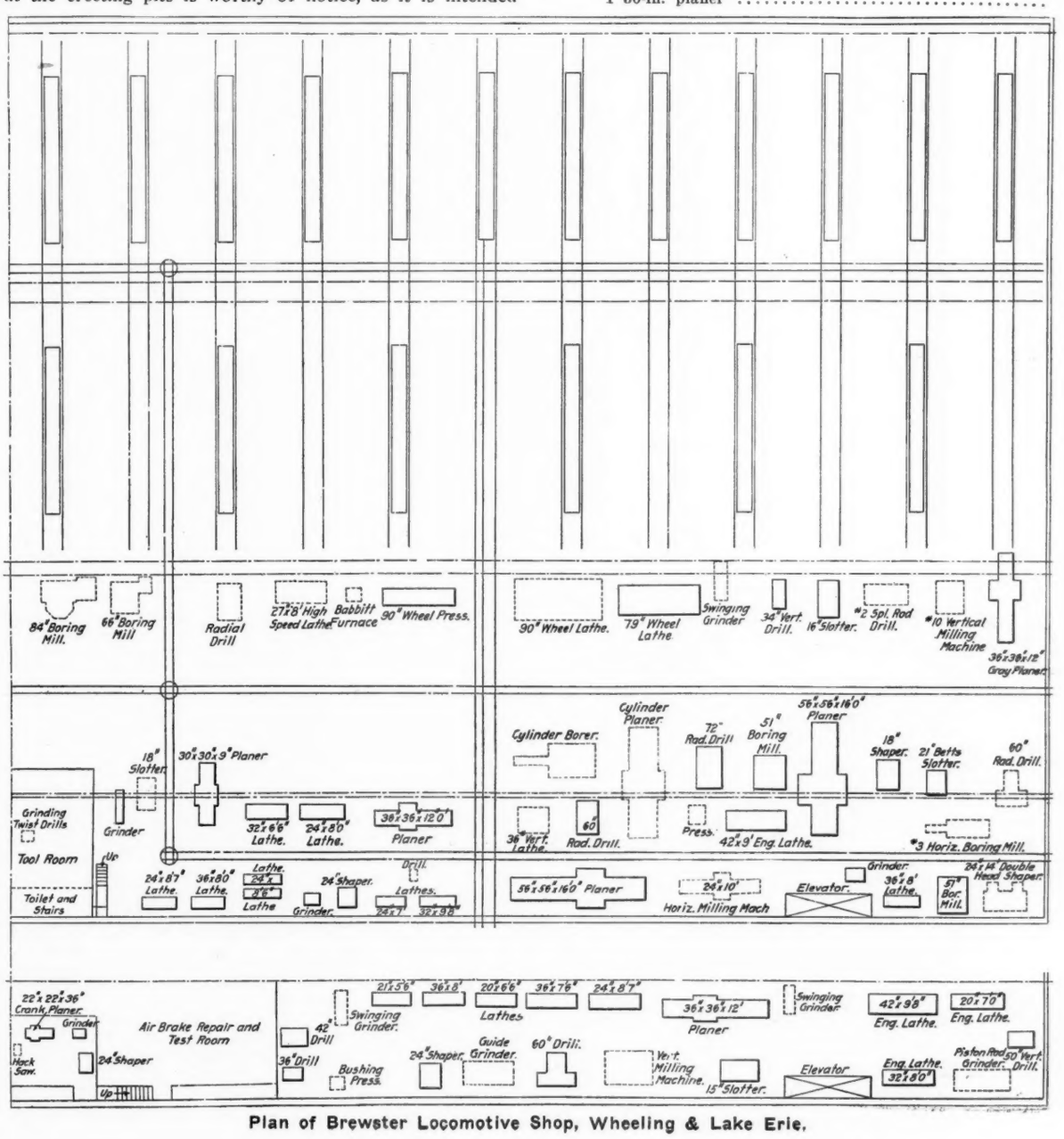
The list of tools includes those to be removed from the other shops and the new tools purchased. On the plan the former are shown by full lines, while the new tools are indicated by dotted lines. In the lists of tools which follow the new tools are indicated by asterisks.

Cylinder Section.

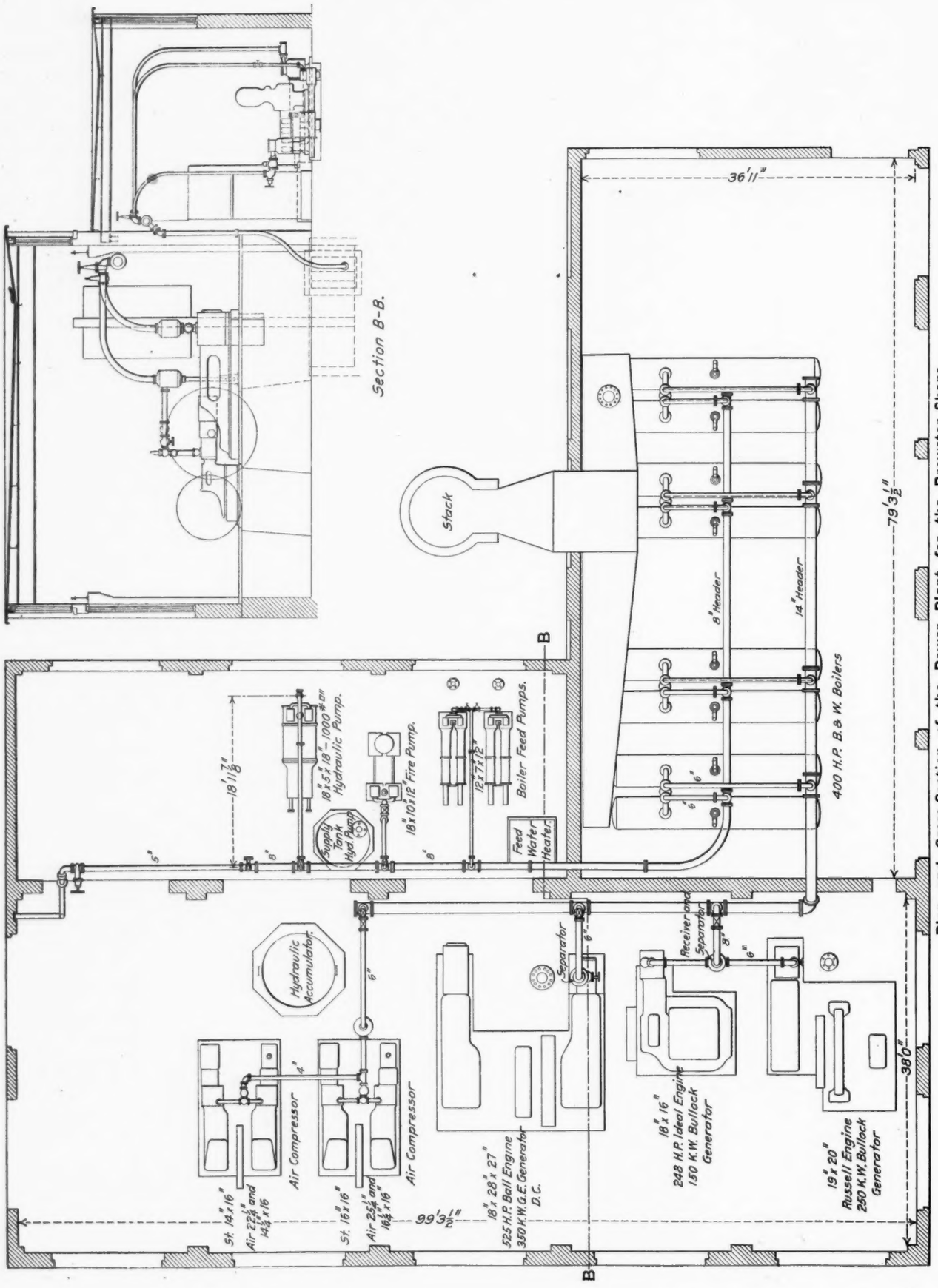
No.	Name.	Make.
1	72-in. radial drill	Niles
1	60-in. radial drill	Bickford
1	32-in. lathe	Enterprise
1	24-in. lathe	Pond
1	36-in. planer	Fitchburg
*1	36-in. vertical lathe	Bullard
*1	cylinder borer	
*1	cylinder planer	
*1	power forcing press	

Frame Section.

1	36-in. planer	Fitchburg
1	30-in. planer	



Plan of Brewster Locomotive Shop, Wheeling & Lake Erie.



Plan and Cross-Section of the Power Plant for the Brewster Shops.

Link Motion

No.	Name.	Make.
1	42-in. vertical drill	Niles
1	50-in. vertical drill	Bement
1	60-in. radial drill	Bickford
1	42-in. lathe	L. & S.
1	20-in. lathe	L. & S.
1	24-in. lathe	Fitchburg
1	15-in. slotter	Bement
1	32-in. lathe	S. & B.
1	36-in. planer	Pond
1	24-in. shaper	Niles
1	56-in. planer	Gray
1	15-in. slotter	Bement
*2	swinging grinders	W. & L. E.
*1	No. 9 vertical milling machine	
*1	10-ft. horizontal milling machine	
*1	50-ton press	Lucas
*1	guide bar grinder	Diamond
*1	piston rod grinder	Landis

Rods.

1	34-in. vertical drill	Fitchburg
1	36-in. planer	Gray
1	16-in. slotter	Niles
*1	12-in. 2-spindle rod drill	Newton
*1	swinging grinder	W. & L. E.
*1	No. 10 vertical milling machine	Newton

Miscellaneous Machine Tool Work.

1	2-head 51-in. swing head vertical boring mill	Bullard
1	radial drill	American
1	radial drill	Bickford
2	floor grinders	Diamond
1	24-in. lathe	Pond
1	36-in. lathe	Niles
1	32-in. lathe	S. & B.
1	20-in. lathe	Star
1	42-in. lathe	Fitchburg
1	21-in. lathe	Le Blond
1	36-in. lathe	Pond
2	24-in. lathes	L. & S.
1	36-in. lathe	Niles
1	24-in. lathe	Fifield
1	36-in. lathe	Niles
1	21-in. slotter	Betts
1	24-in. shaper	Enterprise
1	5-ton jib crane	
1	1-ton jib crane	
*1	No. 3 horizontal boring mill	Bement
*1	84-in. boring mill	H. & W.
*1	60-in. radial drill	
*1	swinging grinder	W. & L. E.
*1	24-in. double-head shaper	
*1	18-in. slotter	

Wheel Section.

1	79-in. wheel lathe	Niles
1	56-in. planer	Pond
1	42-in. wheel borer	Niles

No.	Name.	Make.
1	300-ton 90-in. press	Niles
1	18-in. press	Niles
1	18-in. shaper	Cincinnati
1	51-in. boring mill	Bement
*1	42-in. wheel lathe	
*1	babbitt furnace	
*1	axle lathe	
*1	27-in. high-speed lathe	Pond
*1	90-in. wheel lathe	Niles
*1	66-in. boring mill	
*1	6-ft. radial drill	Pond

Special Equipment and Brass Finishing.

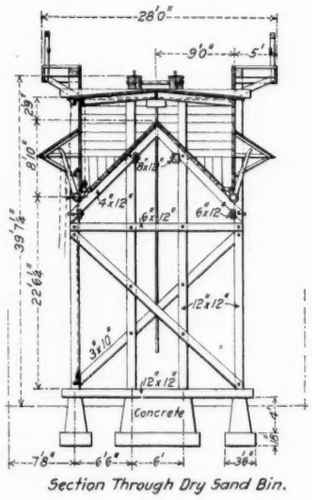
1	4-spindle nut tapper	Acme
1	2-in. S. H. bolt threader	Acme
1	17-in. lathe	Le Blond
1	36-in. turret lathe	J. & L.
1	24-in. turret lathe	J. & L.
1	26-in. turret lathe	P. & W.
1	double guide grinder	Blount
1	18-in. brass lathe	American
1	14-in. lathe	L. & D.
1	18-in. lathe	
1	vertical drill	Harrington
1	double bolt cutter	Acme
*1	18-in. bolt turning machine	Lassiter
*1	2-in. bolt pointer	Acme
*1	1½-in. bolt altering machine	Lassiter
*1	1½-in. shear	Pawtucket
*1	nut facer	
*1	sensitive drill	Henry & Wright
*1	42-in. turret lathe	
*1	squaring machine	

Tool Manufacturing.

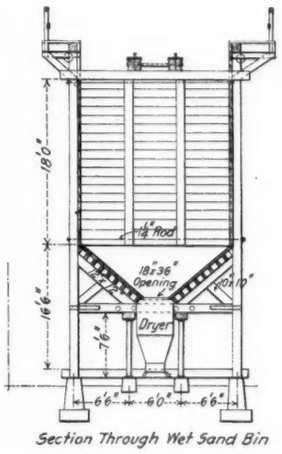
1	29-in. vertical drill	Pond
1	No. 8 grinder	Diamond
1	No. 9 grinder	Diamond
1	16 in. x 5 ft. tool lathe	P. & W.
1	18-in. lathe	S. & B.
1	24-in. lathe	Niles
1	24-in. lathe	S. & B.
1	2-in. bolt threader	
1	No. 1½ universal miller	B. & S.
1	14-in. horizontal boring mill	P. & A.
1	22-in. planer	Pond
1	24-in. shaper	Putnam
*1	universal tool grinder	
*1	universal twist drill grinder	Sellers
*1	universal tool grinder	Sellers
*1	surface grinder	Walker
*1	No. 4 vertical miller	Cincinnati
*2	power hack saws	
*1	chaser grinder	Wallace

Pipe and Copper Shop.

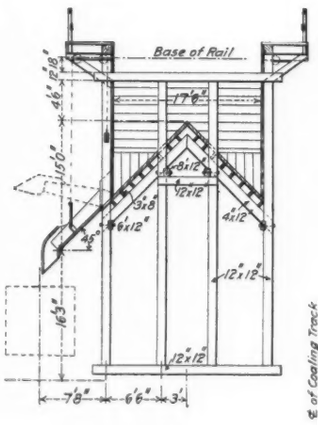
1	4-in. pipe machine	Armstrong
1	No. 30 pipe machine	
2	forges	
*1	open-top oil furnace	Ferguson



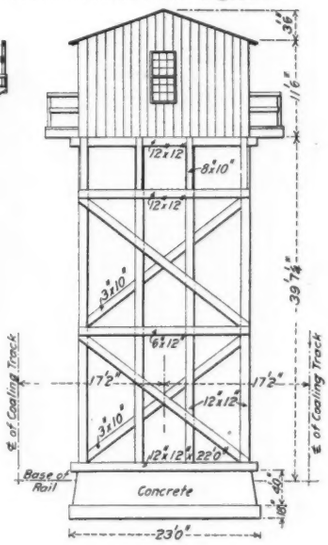
Section Through Dry Sand Bin.



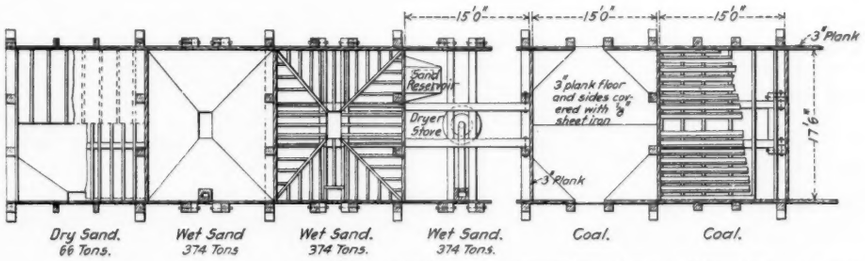
Section Through Wet Sand Bin



Section Through Coal Bin.



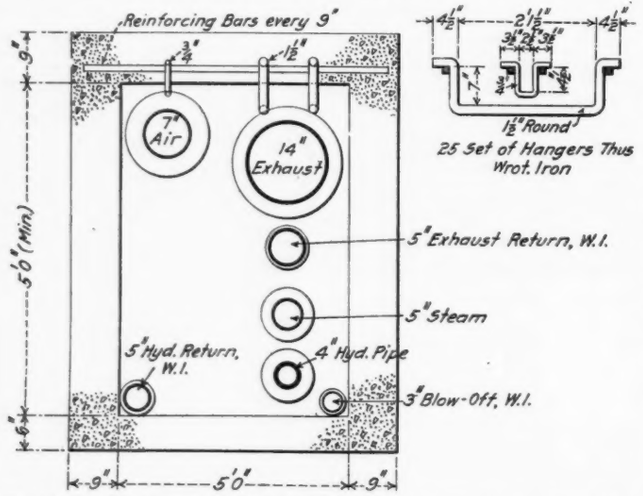
End View



Coaling Station at Brewster, Ohio, Wheeling & Lake Erie.

No.	Name.	Make.
*1	2-in. pipe threader	Saunders
*1	1½-in. pipe bender	P. & A.
*1	pneumatic bender	W. & L. E.
	Tank Shop.	
1	open forge furnace	
1	emery wheel grinder	Blount
1	36-in. punch and shear	Cleveland
1	8-in. horizontal punch	Cleveland
1	hand shear	
1	hand punch	
*1	16-ft. horizontal bending clamp	
*1	24-in. gooseneck drill.	
*1	circular lever shear	
	Boiler Shop.	
1	plate roller.	
1	36-in. double punch and shear	
1	8-in. horizontal punch	L. & A.
1	1-in. x 12-ft. rolls.	Cleveland
1	clamp	W. & L. E.
1	48-in. radial drill	Betts
1	flue furnace (oil)	Ferguson
1	flue tester to 17 ft.	W. & L. E.
1	flue cutter 2-in. to 4-in.	W. & L. E.
1	flue swedger	W. & L. E.
1	16-in. x 16-in. bolt lathe	Flather
1	flue welder, 2-in. to 4-in.	Hartz
1	grinder	Diamond
1	3-ton jib crane	W. & L. E.
1	pressure blower No. 2	Sturdevant
*1	66-in. shear.	Hilles & Jones
*1	66-in. punch	Hilles & Jones
*1	open-flange fire	W. & L. E.
*1	face plate	W. & L. E.
*1	cold saw	Newton
*1	rotary shear	Lennox
*1	17-ft. gap riveter	Chambersburg
*3	rivet furnaces (oil)	Ferguson
*1	special radial drill	Pond
*1	4-spindle staybolt threading and reducing machine	Lassiter
	Blacksmith Shop.	
2	1,500-lb. steam hammers	Bement
1	200-lb. power hammer	Bradley
14	open forges	
1	spring setter, 30 x 60-in.	W. & L. E.
1	spring bander, 16-in. cylinder	W. & L. E.
1	No. 12 pressure blower	Buffalo
1	4-ton jib crane	
1	pneumatic bender	W. & L. E.
*2	oil furnaces	Ferguson
*1	face plate	
*1	power hammer	Beaudry
*2	No. 4 oil furnaces	Ferguson
*1	2-in. forging machine	Ajax
*2	No. 3 oil furnaces	Ferguson
*1	bar shear	Hilles & Jones
*1	angle iron forge	W. & L. E.
*1	angle shear	L. & A.
*1	4,500-lb. hammer	Bement
*1	4-in. forging machine	
*1	oil furnace	Ferguson
*1	oil case-hardening furnace	Ferguson

Power House.—The power house is a substantial building with concrete foundations, brick walls and flat roof, with drainage similar to that of the locomotive shop. It is in the shape of an L, with one long side, 122 ft. 10 in., and the other



Section of Pipe Conduit from Power House to Locomotive Shop.

101 ft. 11 in. It is shown in cross-section and also by a floor plan. The equipment consists of: One 16 x 28-in., 248-h.p. Ideal engine, direct connected to a 150-k.w. Bullock generator, d.c. One 18 x 26 x 27-in. compound, 525-h.p. Bullock engine, direct connected to a 350-k.w. G. E. generator, d.c. One 19 x 20-in. Russel engine, direct connected to a 250-k.w. Bullock generator, a.c. The two d.c. generators are for power current and the a.c. generator is for lighting. One Ingersoll-Rand air compressor, with simple steam cylinders 14 x 16 in. and compound air cylinders 22¼ x 14¼ x 16 in. One air compressor, same make, with 16 x 16-in. simple steam cylinders, compound air cylinders 25¼ x 16¼ x 16 in. The hydraulic accumulator is placed in the engine room, and the hydraulic pump in the pump room has 18 x 18-in. cylinders and 5-in. plungers working against a pressure of 1,000 lbs. per sq. in. There are also two Blake boiler feed pumps, with 12 x 12-in. cylinders and 7-in. plungers, and one Buffalo fire pump with cylinders 18 x 10 x 12 in. There are four Babcock & Wilcox boilers, each 400 h.p., fitted with Roney stokers. The chimney is 9 ft. in diameter and 150 ft. high, made of radial brick and constructed by the M. W. Kellogg Company, New York.

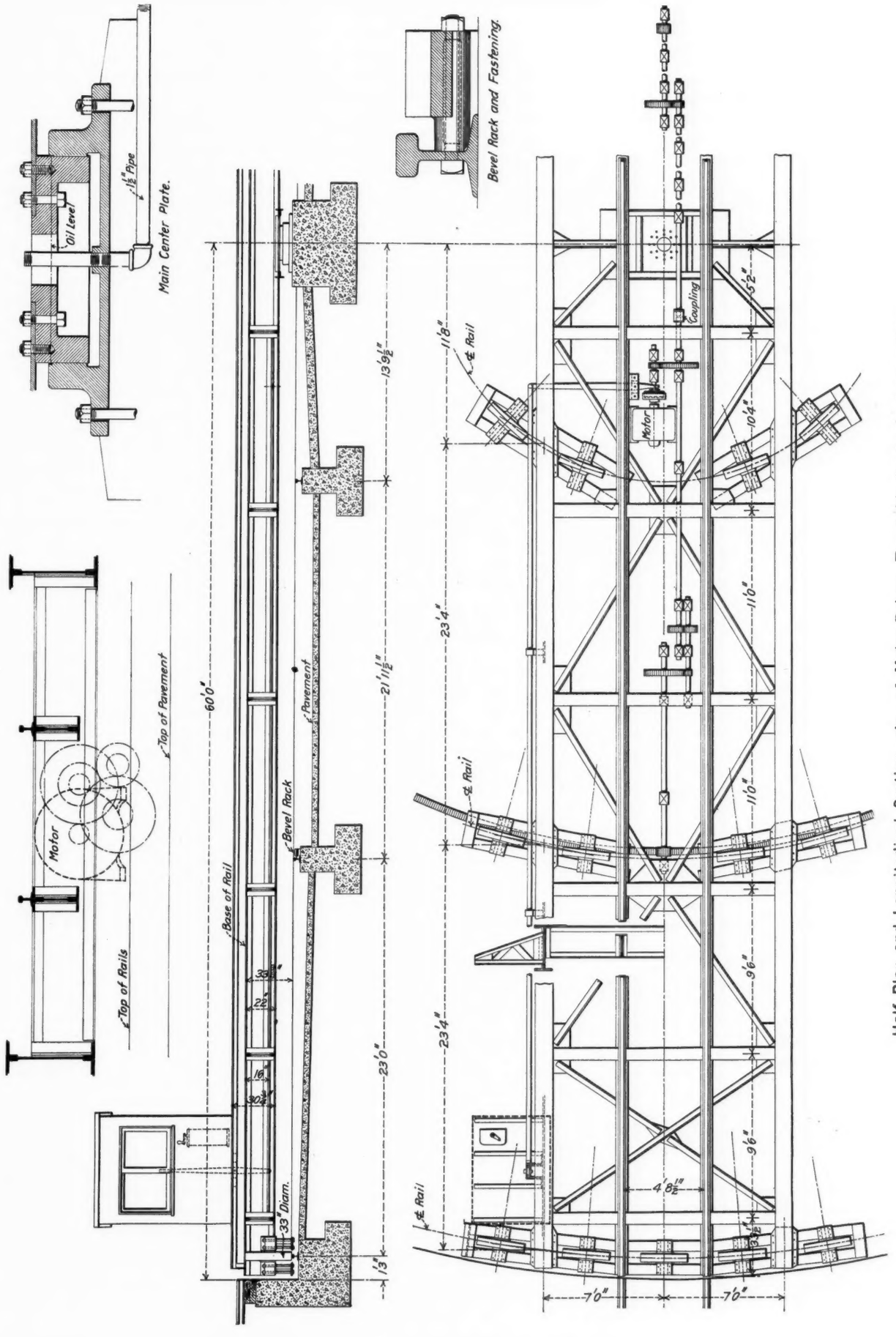
The concrete pipe conduit from the power house to the locomotive shop is shown in section. It is 3 ft. 6 in. x 5 ft. inside and contains one 14-in. exhaust steam pipe, one 7-in. compressed air, one 5-in. live steam, one 4-in. extra heavy hydraulic pipe, one 5-in. hydraulic return and one 3-in. blow-off.

TURNTABLE FOR MALLET LOCOMOTIVES.

In view of the adoption of the Mallet type of locomotive by several large railway systems of this country and the serious consideration being given the matter by many others, the recent application for a patent by Frank H. Adams, engineer shop extension of the Santa Fe at Topeka, Kan., covering a special design of motor driven transfer type turntable for handling such locomotives is very opportune and interesting as solving one of the heretofore annoying problems at locomotive terminals.

For years locomotives and rolling stock have turned on tables centrally supported and having end supports to temporarily take the load while the locomotive or car is being moved to a balanced position on the table, when the latter is revolved by hand by means of a pneumatic or electric motor mounted on a platform hinged from the main turntable structure and driving a wheel in frictional contact with a circular rail near the outer circumference on the bottom of the pit. The adhesion of this wheel due to the weight of the hinged platform, motor and mechanism is sufficient to revolve the turntable when the load is balanced or if there is a slight excess of weight on the motor end. Some of the larger locomotives, with their tenders, represent a total weight in working order of about 350 tons and an extreme length over all of about 110 ft. It is desirable to turn these long locomotives without disconnecting the tenders, and yet a length of 85 to 90 ft. seems about the limit of length from an economical, practical and operating standpoint for which the present type of centrally supported table can be built and kept within a reasonable expenditure.

It is therefore important that suitable means be provided for turning the longer engines by providing a turntable longer and proportionately at a less cost than the present type tables, and one provided with a simple and positive driving device for revolving it. The table here illustrated is intended to meet these requirements. In addition to the usual center foundation and circular rail at the outer circumference of the pit, there are two intermediate circular tracks on substantial foundations. The diameter of the pit is 120 ft. The diameter of the inner circular track is 27 ft. 7 in., and of the intermediate track 71 ft. 6 in. On the same foundation with the latter is a circular rack 5 in. wide, into which gears an 11-in. pinion driven through spur gearing by an electric motor. The speed of this pinion is intended to be 45 revolutions per minute. The main girders of the table are built up plate girders about 5 ft. deep, and these are spread 14 ft. center to center. The girders under the table track are of the same design and 2½ ft. deep. On each side of the center are five transverse plate girders and the



Half Plan and Longitudinal Section, etc., of Motor-Driven Turntable for Large Locomotives.

necessary diagonal bracing at each panel. At each end the table is supported by five 33-in. cast iron wheels, and at the intermediate supports there are four similar wheels, making a total of 26 supporting wheels.

The main center plates are shown in cross-section; the bottom plate is provided with a 1½-in. pipe for convenience in bringing in the wires for the electric motor. It should be understood from the design of the center plates that they are not intended to sustain any part of the load, their function being to maintain the table centrally with respect to the pit and the circular tracks.

The electric motor is located in the first panel near the center plates and one pair of reduction gears is immediately adjacent. The other gears for reducing speed are in the next panel, and the shafting is extended on each side of the center to the final pinion at the circular racks. An operator's cab is supported by brackets on the main girders near one end of the table. Power is transmitted through a friction coupling next to the motor, this coupling being operated by a rod which connects the lever in the cab with that at the coupling. To revolve the table the motor is started to allow full speed under no load, then by means of the connecting mechanism the coupling is shifted into frictional contact and power is transmitted to the pinions at the circular rtack, thus imparting motion to the table. We are indebted to M. H. Haig, mechanical engineer of the Santa Fe, for the drawing and information relating to this new design.

ENGINE FAILURES.

In our issue of April 1 we published data relating to engine failures during the winter months of 1909-10, and suggested that such reports are affected by the interpretation of engine failures, and that it might be possible for the Master Mechanics' Association to adopt a standard for such reports; or, at least, one which might be regarded as recommended practice, so that there would be greater uniformity.

A definition of what constitutes an engine failure, and a list of the delays that should not be considered as engine failures, which are used by the Chicago Great Western, are given below. The explanation of the delays that should not be considered as engine failures is important, as it prevents the reports from becoming so numerous as to be burdensome to the clerks—as they were last winter on many roads—and avoids much useless correspondence.

DEFINITION OF WHAT CONSTITUTES AN ENGINE FAILURE.

"1. All delays waiting for an engine at an initial terminal, except in cases where an engine must be turned and does not arrive in time to be despatched and cared for before leaving time.

"2. All delays on account of engines' breaking down, running hot, not steaming well or having to reduce tonnage on account of defective engine, making a delay at a terminal, a meeting point, a junction connection, with delay to the traffic.

DELAYS THAT SHOULD NOT BE CONSIDERED AS ENGINE FAILURES.

"1. Do not report cases where engines lose time and afterwards regain it without delay to connections or other traffic.

"2. In cases where a passenger or scheduled freight train is delayed from other causes, and an engine (having a defect) makes up more time than it loses on its own account, should not be called an engine failure.

"3. Do not report engine failures on passenger trains when they are less than five minutes late at terminals or junction points.

"4. Do not report engine failures on scheduled freight trains when they are less than 20 minutes late at terminals or junction points.

"5. Do not report as an engine failure delays when an engine is given excess of tonnage and stalls on a hill, providing the engine is working and steaming well.

"6. Do not report delays account engine failures on extra dead freight trains if the run is made in less hours than the miles divided by ten.

"7. Do not report engine failures on account of engines steaming poorly, or flues leaking, on any run where the engine has been delayed on side tracks other than by defects of engine, or on the road an unreasonable length of time, say 15 hours or more per hundred miles.

"8. Do not report an engine failure for reasonable delays in cleaning fires and ash pans on the road.

"9. Do not report failures against engines that are coming from outside points to the shops for repairs.

"10. Do not report as an engine failure cases where an engine is held in the roundhouse for needed repairs, and called for by the operating department, they being informed that the engine will not be ready until a stated time. Failure to provide that engine before that stated time should not be called an engine failure.

"11. Do not report as an engine failure broken draft rigging on engines and tenders caused by air being set on train, account of bursted hose or breaking in two.

"12. Do not report as an engine failure delays when the weather conditions are such that it is impossible to make the time, providing the engine is working and steaming well.

"13. Do not report as engine failures delays when an engine gets out of coal and water, caused by being held between coal and water stations an unreasonable length of time.

"14. Do not report as engine failures delays where work is done on engines while waiting for other trains to meet or pass, or while the station work is being done.

"15. Do not report as engine failures delays due to engines striking obstructions on or beside the track.

"16. Do not report as engine failures delays due to brakes, tank hose, steam heat hose, injector pipes and ash pans freezing.

"It is understood that the train despatcher will make five copies of each engine failure report. The superintendent will send one copy to the general superintendent, and one each to the superintendent motive power and machinery, assistant superintendent motive power and machinery and master mechanic, retaining one copy for his file. As this information will be checked against engineers' reports, despatchers and conductors must therefore give correct cause and particulars.

"If the master mechanic considers an engine failure unjustly charged, he will write to the superintendent giving his reasons and send a copy of his letter to the superintendent motive power and machinery and the assistant superintendent motive power and machinery. If, upon investigation, the superintendent finds an engine failure has been charged without cause, he will cancel it, using regular daily report blanks for this purpose, and will send a copy to the general superintendent, superintendent motive power and machinery and division master mechanic."

FOREIGN RAILWAY NOTES.

Material advances in the pay of employees of the Swedish state lines went into effect in 1908. Theretofore the net earnings had been about 4 per cent. on the capital invested. This sunk to 1.46 per cent. in 1908 and 1.79 in 1909.

The Birsigtal Railway, a narrow-gage line extending for eight miles into the country from Basel, Switzerland, not long ago raised the price of commutation tickets. Thereupon about four-fifths of its patrons "struck," and the road alongside the railway was thronged with hay-wagons and bicycles, carrying the people to and from town.

The ministry of public works of Turkey has in view projects for building two lines in Albania, one from Monastir to the Adriatic sea, the other from the Mitrovitza railway to the Adriatic. Still another line will join the Provinces of Roumelia with Baba Eski, Kirk Kalisse, Mouratli, Rodosto Devlet aghatch and Hairabol. Two plans for this line are being examined.

General News Section.

The Grand Rapids & Indiana has put the manual block system in use between Fort Wayne, Ind., and Sturgis, Mich., 57 miles.

The Grand Trunk and the Canadian Pacific have each accepted the award recently granted by an arbitration board increasing the pay of conductors and trainmen. At last accounts the employees had not accepted the award.

The Chicago, Milwaukee & St. Paul is installing telephones for use in train despatching on its line between Marion, Iowa, and Council Bluffs, 260 miles. This road already has telephones in use on train wires on several hundred miles of its lines.

The Indiana State Railroad Commission announces that it will impose the penalties of the law on station agents who do not bulletin the probable arriving times of trains. Inspectors of the Commission are going to report all cases of neglect and irregularity.

On the morning of June 27, about 2 o'clock, a passenger train of the Oregon Short Line was stopped by robbers within the city limits of Ogden, Utah, and all of the passengers, about 100, compelled to give up their valuables. The express messenger was made to deliver the contents of the safe.

At Albany, N. Y., June 27, E. A. Durant and G. Oliver, grain merchants; H. C. Palmer, formerly a freight agent of the Delaware & Hudson, and W. R. Conley, grain inspector for the Albany Board of Trade, were indicted on charges of grand larceny in connection with the issue of fraudulent bills of lading.

On Friday last the Pennsylvania Railroad ran a special train over the new lines of its New York City terminals (soon to be opened) for the accommodation of the superintendent of telegraph and a large party of division operators, foremen and other employees of the telegraph department, from all parts of the company's lines east of Pittsburgh.

Hamilton Carhart, of Detroit, Mich., has given $100,000 toward the erection of a new building for the National Railway Men's Home at Highland Park, Ill. Mr. Carhart is a manufacturer of overalls and he says the gift is in appreciation of the fact that the railway men have helped to make him wealthy by using extensively the garments he has made.

Count Zeppelin's passenger airship, "Deutschland," with which he had proposed to carry passengers on excursions regularly, has already been wrecked, having been caught last Tuesday in a violent wind and rain storm. Thirty-three persons were aboard the airship, and it landed on the tops of the pine trees in a dense forest, but all of the passengers and crew escaped safely. The extent of the damage to the airship is not clearly indicated in the despatches.

The Boston & Maine has made an increase of from 20 to 25 cents a day in the pay of a large number of stationmen and clerks. The New York, New Haven & Hartford has made an increase of about $1 a week in the pay of a large number of clerks. The Philadelphia & Reading has increased the pay of enginemen and firemen on yard engines. The Great Northern and the Northern Pacific have made an increase of 2 cents an hour in the wages of 1,400 machinists.

The Toll Roads Commission of Pennsylvania, appointed by the last legislature, recommends the abolition of all toll roads in that state. There are still in Pennsylvania 107 companies owning 713 miles of highways on which tolls are charged. It is estimated that to make these roads free will cost the state $2,000,000. It is proposed to lay one-half of the cost of the maintenance of the roads in the future on the state, one-quarter on the county and one-quarter on the borough.

Hohokus, long obscure, is now a railway center. The New Jersey Rapid Transit Company has established a street-car line to that place from Paterson.

The railway commissioners of Indiana have had much to say during the past few years concerning the dangers connected with highway grade crossings in that state, and have urged that action be taken by the state and municipal authorities; but little or nothing has been said about the cost of removing these dangers. By way of supplying this lack in the commissioners' proposals, it may be noted that the Mayor of Indianapolis, recently quoted, says that the cost of the necessary elevation of tracks to carry out the separation of grades in that city will cost a trifle over $22,000,000.

Houston, Tex., reports say that the locomotives on the Victoria division of the Galveston, Harrisburg & San Antonio are to be changed back into oil burners. This order will affect about 25 engines and will necessitate the installation of a number of new oil supply plants, as the old ones have all been demolished. The engines on the Victoria division were changed from oil to coal burners about three years ago, and since then they have been using coal supplied by the coalfields in Oklahoma. It is said that coal has reached a price that is practically prohibitive for use in locomotives.

Governor Hughes, of New York, has approved the bill placing telegraph and telephone companies under the authority of the Public Service Commission of the second district. The Governor thinks that the telephone companies in the first district ought to be under the authority of the commission for that district, but, nevertheless, has signed the bill. He also criticises the law as not sufficiently comprehensive in the authority granted to control the issue of securities by telegraph and telephone corporations. The Governor has also signed the bill amending the labor law in relation to compensation to workmen injured in certain dangerous employments.

At the commencement exercises at Yale University on Wednesday, June 22, James J. Hill, chairman of the board of directors of the Great Northern Railway, received the honorary degree of Doctor of Laws. In presenting Mr. Hill, Professor Perrin said: "Our great Northwest produced Mr. Hill, and he has retaliated by producing a new Northwest. He entered the transportation business as a clerk in 1856. The year 1869 saw him in the business on his own account, and the year 1893 found him president of the Great Northern. His power is practically without bounds—but he cannot raise the freight rates on his own railway. He is the last of a generation of wilderness conquerors. He believes in education of the widest and most thorough sort, and his gifts to this cause have been great and continuous. But the greatest things in all his greatness are his belief in the spiritual significance of man and his longing for the perpetuation of American institutions at their highest and best."

James J. Hill Advocates Decentralization of Terminals.

A paper by James J. Hill was read at the meeting of the National Association of Millers at Minneapolis on June 23, in which Mr. Hill said in part:

"One fact, it seems to me, should give you more concern than almost any other, because you have already felt its effects and because it looms large and dangerous. This is the pressure upon existing terminal facilities. It is a future menace and a present handicap.

"For months past it has been impossible to get freight shipments delivered promptly if these have to be transferred at any of the central markets or principal terminal points. The flood of business that rose to such dangerous height in 1907 is piling up again, with the additions made by natural growths since then.

"The future will add in increasing ratio to these difficulties, as well as to the losses they involve. The only probable relief from the pressure upon our transportation agencies, and especially upon terminals, where the greatest difficulty exists, is the decline of our export trade. The demand of the home consumer is lessening the volume of our export of foodstuffs, and will affect similarly some other items on the list. But this change will bring relief to the carrier only in so far as export terminals are concerned.

"An enormous volume of new traffic is being developed by the industrial advance of the country between the Mississippi

river and the Pacific coast. All of this must seek its market; and much of it will be added to the total that already overburdens our terminals.

"In the great markets of the eastern half of the country, in New York, Cleveland, Buffalo, Chicago, the crisis has already arrived. Traffic growth and terminal congestion are applying the brakes to business progress. This means trouble for the whole country.

"It is no more disastrous to have the banks close their doors than to have the railways choked. The interest which you represent must suffer with the other, and therefore it should be taking thought with others for the future. For the same cause will work out the same effects in the West.

"What is the remedy? Decentralization of traffic terminals offers a partial cure, partial only, however, because it is applicable only to a portion of the business to be done.

"The problem of terminals is the greatest problem of the country, the problem of transportation agencies, of financiers, of the communities directly affected and of all the industries that depend directly or indirectly upon cheap and speedy carriage for the commodities which they buy and sell. It is a problem for everybody, since probably not one business man in the whole country would fail to feel the disastrous effects if it were to be neglected for the next five years as it has for the last ten, and to blight every form of activity by paralyzing the whole trade."

An Exchange of Compliments.

First among railway officers to dare to say that it would (or might) be safe to entrust the Interstate Commerce Commission with rate-making power was a president of the Pennsylvania Railroad (Mr. Cassatt); and now it is the president of that road who first formulates the railway view as to how the commission should proceed under its new power to suspend proposed increases. Mr. McCrea, with other presidents, received from Chairman Knapp of the commission the following telegram:

"Several complaints have been filed against advances in commutation rates between New Jersey points and New York City, and the commission is urged to suspend the same. The new law has not been carefully examined, and some of my associates are absent. Under the circumstances, and to afford opportunity for proper consideration, both as regards our power and the propriety of its exercise, the commission requests your company to postpone until August 1 the effective date of tariff announcing these advances. Your compliance with this request, will be highly gratifying and permission to postpone will be granted application."

Mr. McCrea sent the following reply:

"While our company feels that the proposed increase in these rates is abundantly justified and can readily be so demonstrated, and while it is also advised and believes that the commission is not invested with any power either by the old or the new law to suspend the same, nevertheless I feel that the request so courteously expressed by you as chairman of the commission should not be declined, and therefore the Pennsylvania Railroad Company will comply therewith and ask for permission to postpone, with the understanding and on the condition, of course, that the rates shall not be suspended beyond August 1."

To a farmer, the proviso in the last two lines of Mr. McCrea's letter would suggest, probably, the cow that gave a pail full of milk and then, by the power of her strong hind leg, overturned the same.

Proposed Engineering Building in Boston.

A committee of the engineering societies of Boston, Mass., Ira N. Hollis, chairman, announces a project which is said to be well under way, for the construction of a large building in Boston for club and society headquarters and for offices which shall be similar to the United Engineering building and Engineers' Club in New York City; and a circular has been issued asking for the co-operation of all persons interested. About 350 engineers have already given the project their endorsement and it is desired to get ten or twelve hundred more. The committee hopes to form a club of 1,000 resident members from the engineering, architectural, scientific and artistic professions, to pay annual dues of $50, and 500 non-resident members at a lower rate. The circular contains tentative plans and an architect's perspective of an eight-story building about 100 ft. x 200 ft., but no definite site is named. The secretary of the committee is L. S. Cowles, 101 Milk street, and the societies interested are the following:

Boston Society of Civil Engineers.
American Institute of Electrical Engineers.
American Society of Mechanical Engineers.
American Institute of Architects (Boston Chapter).
Illuminating Engineering Society (New England Section).
National Electric Light Association (New England Section).
New England Association of Gas Engineers.
New England Street Railway Club.
New England Water-Works Association.
American Chemical Society (Northeastern Section).
Society of Chemical Industry (New England Section).
Telephone Society of New England.
New England Railroad Club.

Disastrous Train Wreck in Mexico.

In the derailment of a runaway train on the National Railways of Mexico, in the state of Colima, June 23, over 60 persons were killed and more than 100 were injured, nearly all the victims being soldiers. The car that was most completely wrecked was filled with officers and their families. The train, consisting of four cars, had broken away from its engine on an ascending grade and, after running back several miles at high speed, jumped the track at a curve. The conductor and engineman were arrested and put in jail.

Spokane Transportation Club.

The Spokane Transportation Club met at the regular monthly dinner on June 17, 1910, at Spokane, Wash. The subject of Through Billing was discussed, it being the desire of the members to secure the billing of freight direct from New York and Chicago to Spokane & Inland Empire points. George M. Hofford, auditor of the North Coast, read a paper on "Railroad Accounting." E. J. Cannon, counsel for the Northern Pacific at Spokane, made a short speech regarding the steady reduction in freight rates and the improvement in traffic conditions.

It was unanimously voted to accept the invitation extended by Waldo G. Paine, for the Spokane & Inland Empire Electric system, and J. C. White, for the Red Collar Steamboat line, to hold the annual picnic of the club on July 20, on the St. Joe river. This is about 40 miles from Spokane, and is reached by the cars of the electric line to Coeur d'Alene, thence by boat on Coeur d'Alene lake to the mouth of the St. Joe river.

American Street and Interurban Railway Manufacturers' Association.

Charles C. Castle, chairman of the Membership Committee of the American Street and Interurban Railway Manufacturers' Association, has issued a circular, on behalf of the executive committee, upon the subject of an increase in membership. Mr. Castle asks of those concerned in the interests of the association that they use personal efforts to extend membership by soliciting those eligible in their immediate territory. The annual convention of the American Street and Interurban Railway Association, with which the manufacturers' association is affiliated, will be held at Atlantic City, N. J., October 10-14, inclusive. A large attendance is assured, and the exhibits will occupy much more space than in any other year in the past. All inquiries for exhibit space should be sent to K. D. Hequembourg, vice-president, at Dunkirk, N. Y. Communications on the subject of new members will reach Mr. Castle if addressed to him as manager of the railroad department of the U. S. Metal & Manufacturing Co., 165 Broadway, New York.

Car Inspectors and Foremen.

The Chief Joint Car Inspectors and Foremen's Association of America will hold a meeting in Washington, D. C., September 6 to 8, 1910, inclusive.

Railway Signal Association.

The annual meeting of this association will be held at the Hotel Jefferson, Richmond, Va., October 11, 1910.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.
AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; June 17; Omaha, Neb.
AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—C. M. Burt, Boston, Mass.; next meeting, St. Paul, Minn.
AMERICAN ASSOC. OF LOCAL FREIGHT AGENTS' ASS'N.—G. W. Dennison, Penna. Co., Toledo, Ohio.
AMERICAN ASS'N OF RAILROAD SUPERINTENDENTS.—O. G. Fetter, Carew Bldg., Cincinnati, Ohio.
AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York.
AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago; Oct. 18; Fort Worth, Tex.
AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASS'N.—E. H. Fritch, Monadnock Bldg., Chicago
AMERICAN RAILWAY INDUSTRIAL ASSOCIATION.—G. L. Stewart, St. L. S. W. Ry., St. Louis.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Building, Chicago.
AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—O. T. Harroun, Bloomington, Ill.; July 12; Chicago.
AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. Edgar Marburg, Univ. of Pa., Philadelphia; June 28-July 2; Atlantic City.
AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and August; New York.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 29th St., N. Y.; 2d Tues.; New York.
AMERICAN STREET AND INTERURBAN RAILWAY ASS'N.—H. C. Donecker, 29 W. 39th St., New York; Oct. 10-14; Atlantic City.
ASSOCIATION OF AM. RY. ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; June 29, 1910; Colorado Springs.
ASSOCIATION OF RAILWAY CLAIM AGENTS.—E. H. Hemus, A., T. & S. F., Topeka, Kan.
ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Wis. Central Ry., Chicago
ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York.
BUFFALO TRANSPORTATION CLUB.—J. N. Sells, Buffalo.
CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug..; Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; Thursdays; Montreal.
CAR FOREMAN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month; Chicago.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton Building, Pittsburgh; 1st and 3d Tuesdays; Pittsburgh.
FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.
GENERAL SUPERINTENDENTS' ASS'N OF CHICAGO.—H. D. Judson, 209 Adams St., Chicago; Wednesday preceding 3d Thurs.; Chicago.
INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.
INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASS'N.—A. L. Woodworth, Lima, Ohio; Aug. 16-18; Detroit, Mich.
INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, rue de Louvain, 11, Brussels; July 4-16; Berne, Switzerland.
IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago.
NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in month. ex. June, July, Aug. and Sept.; Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
NORTH-WEST RAILWAY CLUB.—T. W. Flanagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, August; St. Paul and Minn.
NORTHERN RAILWAY CLUB.—C. L. Kennedy, C., M. & St. P., Duluth; 4th Saturday; Duluth, Minn.
OMAHA RAILWAY CLUB.—A. H. Christiansen, Barker Blk.; 2d Wed.
RAILWAY CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City; Third Friday in month; Kansas City.
RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.; annual, Oct. 11; Richmond, Va.
RAILWAY S'KEEPERS ASS'N.—J. P. Murphy, Box C., Collinwood, O.
RICHMOND RAILROAD CLUB.—F. O. Robinson; 2d Monday; Richmond.
ROADMASTERS' AND MAINTENANCE OF WAY ASS'N.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; annual, Sept. 13-16; Chicago.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
SOCIETY OF RY. FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago.
SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. R. Ry., Montgomery., Ala.; annual, Oct. 20; Atlanta.
SOUTHERN & SOUTHWESTERN R.R. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., Mar., July, Sept. and Nov.; Atlanta.
TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August; New York.
TRAIN DESPATCHERS' ASS'N OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago.
TRANSPORTATION CLUB OF TOLEDO.—L. G. Macomber, Woolsen Spice Co., Toledo.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo; annual meeting; Aug. 16-19; Niagara Falls, Ont.
WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg; 2d Monday, except June, July and August; Winnipeg.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; Wednesdays, except July and August; Chicago.

Traffic News.

The order of the Interstate Commerce Commission reducing sleeping car fares has been suspended until July 12. This is to allow time for further application to the court in Chicago.

Five carloads of silk arrived in New York last week from Yokohama in 16 days, 16 hours and 45 minutes. The silk came by the Great Northern steamship and over the Great Northern railway to the eastern terminus of that line; thence over a line whose advertising agent has not yet reported, and arrived in New York over the New York Central.

The New York, New Haven & Hartford has announced increases in passenger fares throughout a large part of those divisions of the road on which traffic is light. The newspaper statement that the new tariffs made an increase of 20 cents in the fare from Springfield to Hartford, 26 miles, are misleading, this increase applying only on the line through Melrose and not on the main line. The increases vary from 10 per cent. to 20 per cent. They take effect July 23.

The Burlington expects to begin about September 1 to interchange traffic with the Nashville, Chattanooga & St. Louis across the Ohio river at Metropolis City, Ill. Its new line to Metropolis City is nearing completion, and in course of time it will build a bridge across the river to Paducah, Ky., which is the terminus of the Nashville, Chattanooga & St. Louis. For awhile, however, the interchange of traffic will be made across the river by ferries. By this arrangement the Burlington will for the first time be able to transfer traffic directly with a southeastern line.

The revised tariffs on sugar in carloads from New York to the West, which have been issued since the conference on sugar rates between the trunk lines and the lines leading north from New Orleans, show the following rates: New York to St. Louis, all rail, 25 cents per 100 lbs.; lake and rail, 23 cents; New Orleans to St. Louis, 17 cents. To points on the Mississippi river north of Fort Madison the New Orleans rate is 4 cents less than the all-rail rate from New York; to Peoria this difference is 6 cents; to Cairo, 8 cents, and to Louisville, 6 cents. To Detroit from New York the all-rail rate is 20 cents; from New Orleans, 23 cents.

The "Hog Special" is the latest announcement of the passenger department of the Texas & New Orleans. This title does not refer to a passenger train assigned particularly to that class of passengers which is made up of "undesirable citizens." It is a train composed mainly of freight cars fitted with a series of pens for the exhibition of extra fine swine. Why the passenger department should be humiliated by being required to father this suggestive enterprise, we are at a loss to understand. The animals are to be taken around the country for the purpose of instructing the farmers in the art of making themselves wealthy by raising, feeding and marketing hogs. The train will leave Dallas at 4 p.m., July 5, and will keep up its travels until July 27. The schedule indicates that at most of its stops this train will stay all day.

The railways in the Central Traffic Association announce extensive increases in freight rates, to take effect August 1. As an example of the amounts by which the rates are raised, the following figures are given from tariffs issued by the Lake Shore & Michigan Southern and other New York Central lines west of Buffalo. The figures given are the first-class rates; the reductions in the other classes are proportionate: Chicago to Buffalo, old 45 cents, new 54; Detroit to Indianapolis, old 37, new 45; Cleveland to East St. Louis, old 52½, new 64; Cleveland to Indianapolis, old 40, new 48; Chicago to Findlay, Ohio, old 37, new 45. It is given out at the office of the Interstate Commerce Commission that these increases in central territory amount to from 10 to 15 per cent. This statement apparently is based on a hasty reading of the tariffs.

Reports have been given widespread currency in the newspaper press this week that the Granger railways seriously fear a crop failure that will cause a heavy reduction in traffic, and in consequence are severely retrenching their expenditures. The vice-president in charge of traffic of one of the largest of these roads, who recently returned to Chicago from an extensive trip over his lines, said to the *Railway Age Gazette* that these reports

must have been put in circulation by some one who had gone short of the market. His personal observation indicates that the wheat crop is in better condition than it was expected to be a few weeks ago, and that the prospects for corn are excellent. His personal observation was confirmed by reports received this week. The road in question operates in almost every state where, according to the newspaper reports, pessimism prevails regarding crop prospects.

Following the protests presented by the attorney-general of New Jersey, the Interstate Commerce Commission last week requested the railways in that state to suspend until July 20 the advances in commutation rates to and from New York City which had been announced, the principal reason given being that the Commission had not yet had time to carefully examine the law of June 18. Many of the roads replied promptly complying with the request, but the Erie did not comply, and the Commission, acting under the new law, thereupon ordered the Erie to suspend its new tariffs until Otober 15. Many of the tariffs suspended were to have gone into effect June 26. On Tuesday of this week it was announced that the Erie had agreed to suspend its rates until July 20, and that the order issued by the Commission had been revoked. The Commission intends to hold a hearing concerning these rates on July 12 in Washington. The Central of New Jersey, in announcing these confusing changes in passenger fares, prints on its placards posted in the stations a copy of Chairman Knapp's telegram requesting the roads to postpone the increases, accompanied by an explanation of just what has been done by the officers of the Central.

Increases in Eastern Rates on Live Stock and Packing House Products.

The agreement reached by the packing house interests and the railways for an advance in rates, which was referred to in these columns last week, applies to the rates on both live stock and packing house products. The rate on dressed meat from Chicago to New York under this agreement is to be raised from 45 to 50 cents per 100 lbs.; that on provisions and packing house products, from 30 to 33 cents; that on cattle from 28 to 31 cents, and that on hogs and sheep from 30 to 33 cents. The agreement, as previously indicated, was due to the "missionary work" of George W. Perkins of J. P. Morgan & Co. The following statement was issued by Armour & Co. at Chicago: "The officials of Armour & Co., having fully considered the question of advancing freight rates applicable to their business, have become convinced that the increases suggested, amounting to about 11 per cent. on the average, are justified by present conditions, and therefore will make no opposition. It is believed that there will be no further opposition on the part of anyone interested."

George B. Robbins, president of the Armour Car Lines and a director of Armour & Co., who represented this concern in the negotiations, said in an interview:

"The advance is so small when applied to a single pound of meat that I don't think it will advance the price. Certainly there is no intention of passing the increase on to the consumer. We were governed in making the agreement by the feeling that it is to the interest of business in general that the rates be increased. What we lose in this way—and it is a considerable amount—we hope to gain by increased business which should result from improving the condition of the railways.

"When the railways are not prosperous there is little prosperity anywhere. The railways need money in order to keep up their facilities and make needed improvements and we are bound to admit they are entitled to some consideration."

No similar agreements for advances in other rates have yet been made.

Negotiations Regarding Terminal Rates at St. Louis.

Negotiations between the railways and representatives of the shippers and the municipal assembly of St. Louis regarding the so-called "bridge arbitraries" at that city have been renewed. A general conference was held on June 20, at which the representatives of the railways rejected the proposition of the differentials against St. Louis on traffic within a zone of 100 miles.

The railways then announced the appointment of a new committee to carry on negotiations for them. This committee is composed as follows: Benjamin McKeen, general manager Vandalia, chairman; C. L. Hilleary, general agent New York Central lines, secretary; R. L. McKellar, assistant freight traffic manager Southern; F. B. Bowes, general traffic manager Illinois Central; Edward Hart, Jr., assistant general freight agent Baltimore & Ohio Southwestern; J. M. Johnson, vice-president Missouri Pacific, and W. C. Maxwell, general traffic manager Wabash.

A comparison of the personnel of this committee with the committee previously appointed to conduct these negotiations shows that it has been considerably changed, and no longer contains any representatives of the small independent lines running from points in Illinois to East St. Louis. (See *Railway Age Gazette* June 24, p. 1781-85.) The next conference on the subject will be held at St. Louis on June 30.

The Missouri Commission and the Missouri River Rates.

The Missouri Railway Commission has taken a step indicating that it intends largely to nullify the effect of the order of the Interstate Commerce Commission in the Missouri river rate case, and the decision of the Supreme Court upholding the Interstate Commission's order. The Missouri Commission has set down for hearing by it on July 6 the question whether it shall order the state rates between the Mississippi and the Missouri rivers—which bound the state on the east and west—reduced to the same basis to which the Interstate Commerce Commission ordered the Mississippi river—Missouri river proportions of the through rates from the Atlantic seaboard to the Missouri river reduced. The through rates from the seaboard to the Missouri river were formerly combinations of the local rates from the seaboard to the Mississippi river and the local rates from the Mississippi river to the Missouri river. The Interstate Commerce Commission, carrying out its principle that the through rate ordinarily should be less than the sum of the local rates, ordered the Mississippi river—Missouri river proportion of the through first class rate reduced similarily, but at the same time indicated that it did not believe that the local rates between the rivers should be reduced. One of the effects is to enable a jobber at either the Missouri river or the Atlantic seaboard to ship goods direct from the seaboard to the Missouri river for less than a jobber at St. Louis can ship them from the seaboard to St. Louis and thence re-ship them to the Missouri river. There is no doubt that this puts the shipper at St. Louis at a disadvantage and the Missouri Commission suspects that it works an undue discrimination against him.

It is understood that the Kansas Railway Commission is preparing a petition asking the Interstate Commerce Commission to apply its through rate principle to goods moving from the East to points in Kansas. At present these rates to Kansas points base on the Missouri river.

Traffic Club of Chicago.

The Traffic Club of Chicago had a golf tournament at the Beverly County Club on June 23, in which the "slow freights" defeated the "expresses" 14 to 9. Charles H. Kingsbury won the first prize in the 30-hole event, and John T. Stockton, president of the club, finished second.

Attorney General Wickersham on Railway Regulation.

Attorney-General Wickersham made two addresses before the Illinois Bar Association in Chicago on June 24, in which he discussed railway regulation. He said that the recent legislation by Congress empowering the Interstate Commerce Commission to postpone the taking effect of a change in rates until it has been thoroughly investigated simply gives effect to the common law principle that a carrier must charge only just and reasonable rates. He added:

"The administration's theory seeks to preserve the initiative of the railway company, but to create a tribunal to which appeal may be made in case of threatened abuse of its power of initiative so that investigation can be had before an apparently unwarranted toll be levied upon the public.

"The opposing theory would destroy all initiative and substitute government initiative for that of the carriers. This would be but one step from governmental ownership.

"Fortunately, as I think, the theory first referred to prevailed with Congress, and, under the new law, the railway companies are, as they should be, left to carry on their business on their own initiative, cautioned by the fact that, in case any proposed action is unduly burdensome to the public, there is a tribunal to which appeal may be had, not simply for restitution, but for the application of the equitable principle of preventing a threatened wrong.

"Such powers as these, exercised with conservative regard to the rights of the carriers and the public alike, as such great powers must undoubtedly be exercised, cannot fail, in my opinion, to remove much of the feeling of antagonism between shippers and carriers which has existed in the past, and be conducive to a greater stability in railway securities than has hitherto obtained."

Mr. Wickersham advocated federal regulation of the issuance of railway securities.

INTERSTATE COMMERCE COMMISSION.

Nashville Properly a Basing Point.

Columbia Grocery Co. v. Louisville & Nashville. Opinion by Commissioner Clark.

Following the ruling of the United States supreme court, the commission holds that because of water competition that is experienced at Nashville, railways may properly charge a higher rate to points intermediate between Nashville and points of origin than to Nashville. (18 I. C. C., 502.)

Must Secure Shipper's Signature.

Southern Cotton Oil Co. v. Southern Railway et al. Opinion by Commissioner Clements.

The initial carrier quoted the lowest rate on cotton linters applicable to shipments moving under a released valuation, but neglected to secure the shipper's signature to such release of valuation. The delivering carrier collected at a higher rate. It is held that it is the duty of the initial carrier not only to advise the shipper of the lower rates applying in case of release of valuation, but when informed of the shipper's desire to avail himself of such lower rates to obtain the shipper's signature in accordance with the tariffs. Reparation awarded. (19 I. C. C., 79.)

Misrouting Not Punishable if Part of Route Is Independent Water Route.

Fred'k De Bary & Company v. Louisiana Western et al. Opinion by Commissioner Clements.

Damages for misrouting are based on the difference in the rate charged and the lower rate applicable via the route directed by the shipper or which the carriers should have used in the absence of any instruction, but to determine the damage all factors in the claimed route must be subject to the commission's jurisdiction and filed in the manner prescribed by law. As part of the route in question in this case, under complainant's instructions, is from port to port, the rate for which is filed with the commission, the complaint must be dismissed. (18 I. C. C., 527.)

Reduction of Rates to Omaha.

Commercial Club of Omaha v. Anderson & Saline River Railway et al. Opinion by Commissioner Clark.

In the Lincoln Commercial Club v. C., R. I. & P., 13 I. C. C., 319, the commission ordered the rate on lumber from southern producing territory to Lincoln, Neb., to be no higher than the rate to Omaha. The railways, therefore, raised the rate to Omaha from 23 cents to 25 cents, and the rate from Lincoln from 24 cents to 25 cents. Within three months the commission ordered that the rate to Des Moines should not be any higher than that to Omaha, and the railways raised the rate to Omaha and to Lincoln to 26½ cents, thus bringing it in line with the Des Moines rate. The commission now finds that the second advance was unreasonable, and that the rate to Omaha or Des Moines should not exceed 25 cents per 100 lbs. Reparation awarded. (18 I. C. C., 532.)

Tent Poles as Baggage.

Pat. Chappelle v. Louisville & Nashville et al. Opinion by Commissioner Lane.

This complaint is brought by the manager of a traveling minstrel show, and alleges, among other things, that the Central of Georgia refuses to carry the Pullman car and a private baggage car containing tent poles and tent of the troupe on its passenger trains, but ignominiously attaches them to freight trains. Later the baggage car was so repaired as to make it acceptable to the Central of Georgia, so no order on this point is required. The commission holds, however, that tents, poles, seats and other equipment of a theatrical troupe, if they can be loaded into an ordinary baggage car, are properly classified as baggage under the rules governing the movement of private baggage and passenger cars. In the absence of specific limitations a private baggage car which contains a stove must be transported at the rate applicable to private baggage cars, not at the rate on combination cars. (19 I. C. C., 56.)

Equalizing Production Conditions Through Coal Rates.

Colorado Coal Traffic Association v. Colorado & Southern et al. Opinion by Chairman Knapp.

The complaint claims that the rates on coal from mines in the Walsenburg district of southern Colorado to points in Nebraska are unreasonable. The principal point made in the complaint is that it costs more to mine coal in the Walsenburg districts than in the Rock Springs coal fields, and that the Rock Springs coal finds readier sale for domestic uses. The rates taken as a whole yield on an average a little more than seven mills per ton per mile, and the commission does not find them unreasonable. The conditions of higher cost of production at certain points than at others are conditions which the railways ought not to be required to equalize by rate adjustments, and, therefore, except in the case where railways have acknowledged that they have made a mistake in the rates from Walsenburg, the commission does not find that the rates complained of are unreasonable. (18 I. C. C., 572.)

The Pleading of Res Judicata.

National Hay Association v. Michigan Central et al. Opinion by Commissioner Cockrell.

The substance of the complaint is that rates collected by the defendants for the transportation of hay and straw, under official classification, are excessive. In 1900 the classification of hay and straw was changed from the sixth to the fifth, and this higher rate has been maintained ever since. The defendant pleaded that the complaint in this case had already been determined in a proceeding involving the same products and the same subject matter, and that the commission cannot, therefore, again inquire into the matter. It is a fact that in October, 1902, the commission decided a complaint brought by the same association and ordered the defendants to desist from charging fifth class rates on hay and straw and ordering them to charge sixth class rates. This order was not obeyed by the defendants. This was before the passage of the Hepburn amendment, and the courts held that the commission had not at that time power to order a rate for the future. The present complaint was filed about a year after the Hepburn amendment. It is plain that while a plea of *res judicata* is perfectly valid as to all that preceded the effective date of the Hepburn amendment, since that date the commission has power to order a rate for the future, and that therefore the present complaint can be considered.

The second objection of the defendants is to the jurisdiction of the commission over classification matters. The commission finds that to this objection the complete answer is that while the case was brought and tried in form as a matter of classification, as a matter of substance it is clearly and undeniably a rate case. Where the classification primarily affects and controls the rates of a railway, the commission is empowered to pass on such rates. (19 I. C. C., 24.)

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF APRIL, 1910.
(See also issues of June 10, 17 and 24.)

Name of road.	Mileage operated; end of period.	Operating revenues: Freight.	Passenger.	Total, inc. misc.	Operating expenses: Maintenance: Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.	Net operating revenues (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
Ann Arbor	301	$112,577	$33,250	$155,420	$31,589	$25,663	$3,616	$48,819	$8,233	$117,920	$37,500	—$18	$12,330	$25,102	$3,377
Arizona Eastern	312*	131,387	38,715	178,750	28,468	10,390	1,944	39,243	3,252	83,297	95,453	....	4,469	90,984	28,854
Atlantic & St. Lawrence	167	70,502	25,068	107,424	17,617	14,601	3,495	49,362	3,017	88,092	19,332	....	6,436	12,896	—19,307
Buffalo & Susquehanna	361	83,569	15,828	104,212	30,867	56,663	1,863	51,439	7,471	148,303	—44,091	—15	4,000	—48,106	—58,240
Canadian Pacific lines in U. S.	233	69,734	47,158	124,570	19,002	17,324	4,742	46,712	3,425	91,205	33,365	....	5,000	28,365	7,750
Central Vermont	411	216,988	71,512	311,110	30,767	64,515	7,237	134,218	7,411	244,148	66,962	489	10,116	57,335	—29,312
Charleston & Western Carolina	340	109,043	23,452	139,267	26,220	32,027	3,747	38,615	3,959	104,568	34,699	....	4,475	30,224	1,488
Chicago, Cincinnati & Louisville	284	96,303	20,882	126,448	22,171	24,009	7,589	64,683	6,000	124,452	1,996	....	6,076	—4,080	8,522
Colorado Midland	337	132,322	26,458	181,282	31,809	37,003	10,096	77,323	5,267	161,498	19,784	—1,040	8,500	10,244	8,241
Detroit & Mackinac	369†	80,935	22,886	110,282	18,011	14,678	2,867	33,591	2,574	71,721	38,561	—238	8,250	30,073	1,719
Detroit, Grand Haven & Milwaukee	190	112,431	35,471	171,864	24,807	31,157	5,739	67,570	4,622	133,895	37,969	—75	2,727	35,167	6,848
Detroit, Toledo & Ironton	441	105,279	10,783	125,648	26,825	27,908	2,723	57,508	9,723	124,687	961	—55	6,510	—5,604	—10,594
Evansville & Terre Haute	310	105,245	50,906	174,762	20,695	17,440	5,074	60,880	5,951	110,039	64,722	—723	12,207	51,792	—10,386
Georgia Railroad	307	167,781	63,091	244,851	23,596	36,698	9,237	114,302	6,816	190,649	54,202	....	2,083	52,119	18,808
Georgia Southern & Florida	395	101,093	51,902	179,789	21,410	50,481	5,826	76,788	9,082	163,587	16,202	....	8,063	8,139	—27,149
Grand Trunk Western	336	346,744	140,848	523,495	103,688	78,086	16,577	198,089	12,958	409,398	114,097	—2,420	29,190	82,487	—55,483
Gulf & Ship Island	307	126,236	31,665	169,018	19,081	18,274	1,544	48,239	7,126	94,265	74,753	....	5,349	69,404	40,235
Hocking Valley	350	336,230	64,680	425,260	54,166	107,978	6,579	148,657	13,326	330,706	94,554	6,058	19,252	81,359	—36,570
Houston & Texas Central	789	262,901	103,752	396,912	63,904	60,753	19,791	198,665	19,685	362,798	34,114	....	16,485	17,629	—22,416
Kanawha & Michigan	175	164,340	26,587	195,571	46,491	63,716	1,316	54,484	5,738	171,845	23,826	39	6,755	17,110	—541
Louisiana & Arkansas	255	104,218	13,421	122,157	12,911	14,369	2,066	29,732	4,024	63,102	59,055	....	2,512	56,543	15,464
Louisiana Ry. & Nav. Co.	350	96,664	16,740	126,844	20,237	12,236	5,408	48,481	8,740	95,102	31,742	....	4,250	27,492	13,026
Louisiana Western	198	87,008	51,252	145,456	23,687	28,467	5,864	49,738	6,257	114,013	31,443	293	5,500	26,236	—39,636
Midland Valley	324	85,345	28,842	119,489	19,404	19,344	2,102	32,728	5,376	78,954	40,535	12,583	2,271	50,847	34,890
Morgan's La. & Tex. R.R. & S.S. Co.	358	214,960	95,531	331,461	78,435	34,359	10,758	125,586	11,788	260,926	70,535	—547	17,000	52,988	—38,483
Nevada Northern	165	117,079	13,975	135,378	8,871	14,352	286	26,651	3,804	53,964	81,414	....	3,122	78,292	17,066
New Orleans Great Northern	275‡	110,667	29,085	146,430	18,814	15,453	3,205	33,239	4,635	75,346	71,084	—26	1,250	69,808	53,378
New Orleans, Mobile & Chicago	403	108,230	31,422	149,347	23,012	13,550	2,634	45,665	9,897	94,758	54,589	....	3,560	51,029	8,613
Richmond, Fredericksburg & Potomac	83	143,525	58,857	239,409	34,444	19,440	2,664	65,272	5,565	127,385	112,024	....	200	111,824	28,808
St. Joseph & Grand Island	319	78,666	32,042	120,634	79,369	18,266	6,433	58,340	6,057	168,465	—47,831	—72	5,389	—53,292	—52,189
St. Louis, Brownsville & Mexico	494§	116,857	42,838	169,900	40,981	15,464	3,178	65,626	7,206	132,455	37,445	....	3,500	33,945	—16,955
Santa Fe, Prescott & Phoenix	257	87,589	30,298	125,360	9,874	10,122	3,110	32,805	5,157	61,068	64,292	....	100	64,192	6,513
Tennessee Central	292	79,005	27,155	113,754	20,076	11,665	2,950	34,509	10,868	80,068	33,686	....	4,200	29,487	9,796
Trinity & Brazos Valley	455	121,210	23,353	149,170	38,752	26,890	9,483	82,695	10,923	168,743	—19,573	....	3,500	—23,073	11,873
Washington Southern	35	45,863	36,816	108,160	9,261	9,507	1,276	35,485	2,190	57,719	50,441	....	2,345	48,097	8,477
Western Maryland	543°	571,650	59,833	656,086	56,849	74,016	9,583	196,513	12,307	349,268	306,818	....	18,500	288,318	.....
TEN MONTHS OF FISCAL YEAR, 1910.															
Ann Arbor	301	$1,079,348	$393,687	$1,577,221	$230,338	$205,290	$39,908	$542,795	$53,685	$1,072,016	$505,205	—$28,498	$123,306	$353,401	$42,914
Arizona Eastern	312*	1,121,792	343,678	1,557,884	402,977	105,600	20,361	362,112	35,387	926,437	631,447	....	57,013	574,434	87,492
Atlantic & St. Lawrence	167	854,327	260,389	1,229,195	268,339	137,769	35,036	446,807	30,854	918,806	310,389	....	64,356	246,034	—9,518
Buffalo & Susquehanna	361	1,567,802	183,957	1,819,718	341,155	580,541	21,465	744,220	77,483	1,764,864	54,854	—276	40,000	14,578	—239,176
Canadian Pacific lines in U. S.	233	623,130	258,842	955,691	192,262	157,247	45,003	404,266	31,982	830,960	124,931	....	50,000	74,931	41,877
Central Vermont	411	2,063,840	854,851	3,144,156	349,137	578,806	83,973	1,312,791	72,465	2,397,172	746,984	7,307	91,050	663,241	178,177
Charleston & Western Carolina	340	1,019,938	265,275	1,353,912	281,805	180,962	31,228	423,005	37,294	954,294	399,618	....	44,750	354,868	63,580
Chicago, Cincinnati & Louisville	284	968,019	249,527	1,291,756	228,879	226,804	83,741	608,835	59,324	1,207,583	84,173	....	36,737	47,436	93,587
Colorado Midland	337	1,423,260	315,074	1,968,641	247,501	340,077	102,268	864,289	56,255	1,610,390	358,251	—4,967	92,585	260,699	—78,658
Detroit & Mackinac	369†	715,480	249,639	1,021,802	163,755	161,992	21,307	326,608	27,485	701,147	320,655	667	86,590	234,732	10,994
Detroit, Grand Haven & Milwaukee	190	1,045,994	459,272	1,726,934	207,362	248,846	57,810	696,183	50,846	1,261,047	465,887	—33	27,272	438,582	128,873
Detroit, Toledo & Ironton	441	1,094,888	130,829	1,325,846	282,749	253,013	28,376	632,151	48,198	1,244,487	81,359	261	65,103	16,517	—53,417
Evansville & Terre Haute	310	1,347,296	518,367	2,058,381	236,411	298,803	50,908	616,454	64,687	1,267,263	791,118	—8,673	93,532	688,913	127,309
Georgia Railroad	307	1,758,477	688,362	2,593,787	317,188	383,587	96,931	1,021,057	71,098	1,889,561	704,226	....	20,811	683,415	220,393
Georgia Southern & Florida	395	1,111,557	600,087	1,988,969	202,731	438,600	58,238	744,734	87,264	1,531,567	457,402	6,442	85,129	378,715	—32,953
Grand Trunk Western	336	3,329,999	1,520,223	5,169,876	594,300	748,647	196,206	1,914,654	128,068	3,581,875	1,588,001	—11,820	291,900	1,284,281	99,229
Gulf & Ship Island	307	1,321,973	349,899	1,781,276	325,915	278,356	13,644	517,903	73,741	1,209,559	571,717	....	50,916	520,801	164,616
Hocking Valley	350	5,276,951	728,456	6,217,480	767,267	1,163,533	74,153	1,754,508	123,161	3,882,622	2,334,858	87,760	214,998	2,207,620	743,950
Houston & Texas Central	789	3,356,464	1,189,444	4,878,351	637,911	568,503	175,213	1,946,012	197,016	3,524,655	1,353,696	....	149,637	120,058	—78,601
Kanawha & Michigan	175	1,968,160	265,064	2,278,469	442,892	543,532	20,825	563,576	44,626	1,615,451	663,018	—171	68,931	593,915	292,252
Louisiana & Arkansas	255	911,736	141,052	1,094,140	161,101	174,157	18,219	276,216	43,110	672,803	421,337	....	21,319	400,018	107,722
Louisiana Ry. & Nav. Co.	350	887,160	157,851	1,165,937	223,865	129,715	49,348	468,906	50,248	931,082	234,855	....	39,900	194,955	151,481
Louisiana Western	198	1,095,411	515,135	1,694,152	199,524	272,247	57,538	481,661	66,886	1,077,856	616,296	—659	57,138	558,499	—134,778
Midland Valley	324	845,395	277,281	1,180,495	185,989	216,423	19,476	327,475	48,706	798,069	382,426	16,486	72,271	326,640	294,471
Morgan's La. & Tex. R.R. & S.S. Co.	358	2,878,680	968,988	4,078,125	567,059	456,092	102,642	1,397,002	128,148	2,650,943	1,427,182	—3,716	174,520	1,248,946	186,437
Nevada Northern	165	1,045,382	144,642	1,230,782	66,491	116,644	3,300	251,307	36,022	473,764	757,018	....	30,623	726,395	205,153
New Orleans Great Northern	275‡	842,602	293,072	1,198,920	202,852	158,922	23,203	299,717	48,303	732,997	465,923	—759	10,700	454,464	385,162
New Orleans, Mobile & Chicago	403	1,055,058	280,633	1,431,488	219,046	137,586	22,142	436,454	86,400	901,628	529,860	....	36,240	493,620	92,202
Richmond, Fredericksburg & Potomac	83	1,003,505	638,416	1,855,625	277,312	218,675	24,425	594,462	48,829	1,163,703	691,922	....	2,000	689,922	146,586
St. Joseph & Grand Island	319	926,166	343,901	1,372,061	443,217	162,934	64,168	556,698	50,806	1,277,823	94,238	—97	55,363	38,778	—348,757
St. Louis, Brownsville & Mexico	494§	826,708	401,300	1,310,504	346,129	110,695	25,909	461,249	66,583	1,010,565	299,939	....	33,000	266,939	16,813
Santa Fe, Prescott & Phoenix	257	832,637	287,382	1,195,542	166,666	91,861	28,109	304,715	51,547	642,898	552,644	....	561	552,083	48,319
Tennessee Central	292	835,833	303,775	1,205,703	191,249	135,059	34,690	379,162	88,756	828,916	376,787	....	41,996	334,791	79,799
Trinity & Brazos Valley	455	1,563,614	201,543	1,805,665	356,712	306,050	59,659	844,076	111,699	1,678,197	127,468	....	35,853	91,615	—10,724
Washington Southern	35	331,909	316,223	853,750	79,583	86,895	10,961	310,741	21,583	509,763	343,987	....	23,449	320,538	51,243
Western Maryland	543°	2,102,315	217,013	2,406,567	171,546	274,002	30,885	770,534	49,824	1,296,791	1,109,776	....	74,000	1,035,776	.....

*Mileage operated on April 30, 1909, 297 miles. †Mileage operated on April 30, 1909, 347 miles. ‡Mileage operated on April 30, 1909, 92 miles. §Mileage operated on April 30, 1909, 454 miles. °Began operations on January 1, 1910. —Indicates Deficits, Losses and Decreases.

The Commission Without Jurisdiction.

Acme Cement Plaster Co. v. Wabash Railroad et al. Opinion by Commissioner Prouty.

Wall plaster is generally transported in bags, and there is a charge of 10 cents to the purchaser for the bag, with the understanding that if the bag is returned with the freight charges prepaid, the 10 cents will be refunded. The defendants have a tariff rule that if the bags are tied in bundles and properly tagged, showing the name of consignor and consignee, one-half of the fourth class rate will be charged, but if these conditions are not fulfilled, the fourth class rate will be charged. In spite of precautions, there are thousands of bags now in possession of the railways, which the complainant refuses to accept, although the bags can be identified by name or brand stamped on them, because the tags have been lost. It is impossible to tell by what customers they have been sent, and credit, therefore, cannot be given. The commission holds that since the measure of damage is based on an understanding existing between the consignor and consignee and not on a rate, that it has no jurisdiction, and, therefore, the complaint is dismissed. (18 I. C. C., 557.)

Rehearing Granted in the Pullman Case.

George S. Loftus v. Pullman Company et al. Supplemental report by the commission.

The Pullman Company and the Great Northern have filed petitions asking the Interstate Commerce Commission to reopen the cases in which the commission found the charges of the Pullman Company generally unreasonable and ordered reductions to permit the introduction of additional evidence, and in addition the companies ask the suspension of the orders (*Railway Age Gazette*, April 15, 1910, p. 982) heretofore made by the commission until the rehearing of the case. The commission declines to postpone further the effective date of the orders. It will, however, assign the cases for rehearing three or four months after the orders have gone into effect.

The principal reason advanced by the carriers in support of their applications is a desire to offer evidence concerning matters which have transpired since the cases were submitted for determination and other evidence which they assume the commission did not have before it when the orders referred to were made.

It is of course true that the commission did not consider evidence which was not in existence at the time the orders were made, but the assumption concerning other evidence is unwarranted and appears to be based upon a mistaken view of the duties to be performed by an administrative tribunal. The conclusion of the carriers concerning the latter seems to be founded upon the fact that the evidence was not specifically offered by any of the parties. It is said the burden of proving that the rates complained of are unreasonable is upon the complaining party, and that until, in the judgment of the carriers whose rates are challenged, a prima facie case of unreasonableness has been made out, it is not necessary for the carriers to make any defense. This, however, leaves no room for the application of information possessed by members of the regulating tribunal, and in this particular case certain portions of the evidence now offered relate to matters which the commission has recently investigated extensively, while other portions cover data included in reports and other documents filed by the carriers in the commission's office. (19 I. C. C., 102.)

No Authority over Alaska.

In the matter of jurisdiction over rail and water carriers operating in Alaska. Opinion by Commissioner Harlan.

The provisions of the act to regulate commerce "shall apply to any carrier engaged in the transportation of passengers or property * * * from one state or territory of the United States or the District of Columbia to any other state or territory of the United States or the District of Columbia, or from one place in a territory to another place in the same territory." The question is now brought up as to whether the commission has the same jurisdiction over rail and water lines in Alaska as it has over similar transportation within New Mexico or Arizona; in other words, is Alaska a territory in the sense that the word territory is usually used in federal legislation? All the territory over which the United States is sovereign, and which has not been erected into states, is governed by Congress. In De Lima v. Bidwell, 182 U. S., 1, the supreme court holds that Congress may deal with territory acquired by treaty; it may administer its government as it does that of the District of Columbia; it may organize a local territorial government, etc. It follows, therefore, that Alaska may be a territory of the United States in a purely geographical sense without being a territory in a political sense. Under the act by which the first civil government was established in Alaska it was provided that the ceded *territory* shall constitute a civil and judicial *district*. Repeatedly through the statutes Alaska is referred to as the district of Alaska. It will also be observed that the government provided for Alaska has no legislature, Congress retaining full powers of legislation and other control as fully as in the District of Columbia. In general statutes relating to territories, an example of a description of a territory is as follows: "That part of the territory of the United States bounded as follows, etc., is erected into a temporary government by the name of the territory of New Mexico." Alaska being a district and unorganized territory has required special legislation by the Congress; it has not at any time been erected into an organized territory. In its enactments, Congress has ordinarily maintained the distinction between the unorganized and the organized territories. In the case of Rasmussen v. U. S., 197 U. S., 516, the attorney-general made two points; first, that Alaska was not incorporated in the United States, and second, even if Alaska was incorporated in the United States, it was not an organized territory. The supreme court held that Alaska had been incorporated in the United States. The second point gave the court a direct opportunity to hold that Alaska was an organized territory, but when considering that question, instead of doing so it simply held that the constitution does apply to Alaska, and therefore, etc. The special distinction between an organized and an unorganized territory is the existence or non-existence of a local legislature. The United States Supreme Court in re Lane, 135 U. S., 443, on a plea that an act which had been committed in Oklahoma, which was then part of what was known as Indian Territory, was not exempted from being considered a felony, because the federal statute provided that any person committing that offense in the District of Columbia or other places *except the territories* over which the United States has exclusive jurisdiction, shall be guilty of a felony. The supreme court said: "But we think the words 'except the territories' have reference exclusively to that system of organized government long existing within the United States, by which certain regions of the country have been erected into civil governments. These governments have an executive, a legislative and a judicial system." Reference has been made to Binns v. United States, 194 U. S., 486, but certainly the ruling in that case, which, as we understand it, deals with the district of Alaska as analogous to the District of Columbia except in details of its government, does not permit this commission when considering a statute that includes the District of Columbia by express reference to include the district of Alaska within its provisions by mere construction. Moreover, the power to regulate rates of railways in Alaska was specifically conferred by the act of 1898 on the secretary of the interior.

Commissioner Clements dissenting:

I am unable to concur in the majority opinion in view of several holdings of the supreme court, which I am convinced are diametrically opposed to the conclusions stated. In Binns v. the United States the court says: "It has been heretofore held by this court in steamer Coquitlan v. United States that 'Alaska is one of the territories of the United States * * *.'" Now, can it be doubted that it is an organized territory?

Much emphasis is laid on the fact that Alaska is not provided with a separate legislative assembly, and this is conceded to be the only other essential element necessary to constitute Alaska an organized territory. I think it is clear from the language used in Binns v. United States that this is not essential to the status of a territory.

In an act of 1906 permitting Alaska to send a delegate to the house of representatives the words "district of Alaska" as

appearing in the title of the act were specifically amended to read "territory of Alaska." In a court of claims the court said: "Alaska is as much a domestic territory as Arizona. It is beyond question that prior to the passage of the Hepburn act the commission had no jurisdiction over rates in Alaska, neither had it in New Mexico or Arizona. Absolutely no reason has been suggested to show why this act is not just as essential to the well being of Alaska as to that of any other part of the United States. It is claimed that the law of 1898 conferring the rate-making power in Alaska on the secretary of the interior is a special act and the act to regulate commerce a general law. True the law related only to Alaska, but it dealt mainly with matters other than the regulation of railway rates. It was, therefore, the general law. A narrow or over technical construction of a law should not be resorted to in any case to rid the commission of inconvenience and difficulty incident to the full performance of its duties.

Commissioners Cockrell and Lane unite in this dissent.

STATE COMMISSIONS.

F. M. Lee, president of the Mississippi State Railroad Commission, died at New Orleans, La., June 24.

The Oregon Railway Commission has adopted the uniform demurrage code recommended by the National Association of Railway Commissioners, except that it has made the penalty for the detention of a car beyond the free time $2 a day instead of $1.

The State Corporation Commission of Virginia has authorized the Washington Southern, extending from Washington to Quantico, to raise its passenger fares from 2 cents a mile to 2¼ cents. The order takes effect July 15. It is expected that a similar order will be granted in favor of the Richmond, Fredericksburg & Potomac.

The Missouri Railway Commission on June 25 issued an order that all trains must come to a full stop not less than 10 nor more than 60 rods from any railway junction or crossing at grade unless such stop is rendered unnecessary by an interlocking plant or other device approved by the written order of the commission. The board states that it has been informed that in many instances the gates used at such crossings are ignored, and says that it does not approve of gates as a means of safety.

The New York Public Service Commission, Second district, has ordered the Delaware & Hudson to reduce the charge for passengers on its short leased line from Ticonderoga to Fort Ticonderoga from 25 cents to 15 cents. The defendants claimed that since a statute expressly gives the company the right to charge 25 cents, the commission has no power to reduce this charge. The commission holds that by an amendment to the public service commission law, the commission is expressly authorized to fix a maximum rate, notwithstanding that a higher rate has been heretofore authorized by statute.

The New York Public Service Commission, Second district, has dismissed the complaint of Milford J. Whedon, of Medina, against the New York Central & Hudson River as to the fare between Medina and Rochester as compared with the fare from Medina to Buffalo. The fare from Medina to Buffalo is 65 cents, for a round trip ticket to Buffalo and return $1.20. The fare charged from Medina to Rochester is 82 cents, and for a round trip $1.60. Thus the company charges 17 cents more for a single trip from Medina to Rochester than it does from Medina to Buffalo, and 40 cents more for a round trip ticket, the distance being the same in both cases. The travel from Medina to Buffalo is by way of Lockport, and a round trip ticket is sold from Medina to Lockport for 64 cents and from Lockport to Buffalo for 50 cents. A passenger from Medina to Buffalo can, by getting off the train at Lockport and buying a round trip ticket at that point to Buffalo, make the trip from Medina to Buffalo and return for $1.14. The New York Central is paralleled from Medina to Rochester by the Buffalo, Lockport & Rochester, an electric road, and by the same electric road to Lockport. From Lockport to Buffalo it is paralleled by a line of the International Railway. The fares charged by the Buffalo, Lockport & Rochester Ry. Co. from Medina to Rochester are the same as those charged by the New York Central; fares charged by it from Medina to Lockport are the same as the New York Central; the fare charged by the International Ry. from Lockport to Buffalo is 50 cents for the round trip. A passenger can make the round trip from Medina to Buffalo by way of these trolley roads, changing at Lockport, for the sum of $1.14. The commission says that the difference between the fare from Medina to Rochester and Medina to Buffalo is due to the competition of the International Railway from Lockport to Buffalo. For a time after the International was constructed from Lockport to Buffalo the New York Central did not meet the rates and found that its business was leaving. It was, therefore, compelled to reduce the rate from Medina to Buffalo or lose business. At the hearing held in Rochester it was admitted by the complainant that the charge made by the company of $1.60 for round trip ticket from Medina to Rochester at the rate of nearly 2 cents per mile was not unreasonable in itself. Any intention to claim that it was unreasonable was explicitly disavowed by the complainant, who expressly based his complaint on the ground of discrimination alone. The commission says that preference or advantage is unquestionably given passenger traffic from Medina to Buffalo over passenger traffic from Medina to Rochester; that the conditions, however, attendant on traffic from Medina to Rochester are not like those attendant upon traffic from Medina to Buffalo; that if an undue and unreasonable preference is given Buffalo over Rochester, it might be corrected by requiring the company to make the same rate from Medina to Rochester that it does from Medina to Buffalo, or requiring the company to make the same rate from Medina to Buffalo that it does from Medina to Rochester; that the latter remedy would afford no benefit to anyone and would be of disadvantage to the railway. The commission says that it would be unjust to the railway to compel it to reduce a rate 25 cents in amount which is conceded reasonable. If the rate were unreasonable a different question would be presented. The commission further says it should be clearly pointed out that to constitute a preference or advantage which is undue or unreasonable the controlling circumstances of the two contrasting cases must be the same. In this case they are not the same from the fact that it is an old and well established principle in rates that it is permissible for a railway to meet competition of water routes as best it can without subjecting itself to a charge of undue or unreasonable preference or discrimination. Same can be said of competition by trolley roads.

COURT NEWS.

The Supreme Court of Missouri, by a vote of four to three, has affirmed the validity of the long-and-short-haul law of that state.

At St. Louis, June 27, Judge Dyer dismissed the suit which was begun by the government, May 31, to restrain proposed increases in freight rates. This is the result of the agreement which was made between President Taft and the railways.

In the United States district court in Iowa, Judge Page Morris has sustained the federal hours-of-service law. The decision was in a case against the Illinois Central. The court held that an engineman's period of 16 hours should begin from the time he was called (to perform duties) a half hour before the schedule time for the departure of his train.

At Charleston, W. Va., June 27, the circuit court dissolved the injunction recently granted against the enforcement of the 2-cent fare law of the state on the Chesapeake & Ohio, and ordered the road to refund at Charleston, Huntington and Hinton all excess which has been collected over two cents a mile. A stay of 60 days was granted to give the railway opportunity to appeal.

In the federal court at Little Rock, Ark., June 24, in proceedings in bankruptcy against the estate of the T. H. Bunch Co., the Rock Island railway company presented and had entered a claim amounting to $205,767. The claim was based on irregularities in connection with bills of lading which, when the Bunch Company failed, were found to have been hypothecated. The railway company paid the drafts connected with the bills of lading. It appears that the freight had been delivered without the surrender of the bills.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Judge Alexander P. Humphrey, general counsel of the Kentucky & Indiana Bridge & Railroad Co., at Louisville, Ky., has been elected president, succeeding C. L. Harris, resigned.

George H. Campbell, general superintendent of the New York division of the Baltimore & Ohio and vice-president of the Staten Island Railway and the Staten Island Rapid Transit Railway, with office in New York City, has been appointed an assistant to the president of the Baltimore & Ohio.

Hauman G. Haugan, comptroller of the Chicago, Milwaukee & St. Paul, has resigned, and will devote his time in future to private business and travel. Mr. Haugan was born Nov. 7, 1840, at Christiania, Norway. He began railway work in 1870 on the Southern Minnesota and has been continuously in the service of that company and its successor, the Chicago, Milwaukee & St. Paul. He has been successively cashier and paymaster, auditor and cashier, secretary to general superintendent, land commissioner, and comptroller, having held the latter office since Jan. 1, 1901.

Operating Officers.

J. A. MacKinnon has been appointed superintendent of the Willmar division of the Great Northern with headquarters at Willmar, Minn., succeeding G. S. Stewart, transferred.

George A. McNicholl, Pacific coast purchasing agent of the Grand Trunk Pacific at Vancouver, B. C., has been appointed superintendent, with office at Prince Rupert, and his former position has been abolished.

W. J. Stoneburner, superintendent of the Quincy, Omaha & Kansas City, with headquarters at Kansas City, Mo., has been appointed superintendent of the Denison-Hillsboro Branch of the Missouri, Kansas & Texas with headquarters at Denison, Tex., succeeding G. Stoner.

F. S. Elliott, superintendent of the Superior and Mesabi divisions of the Great Northern at Superior, Wis., has been appointed assistant general superintendent of the Western district, with office at Spokane, Wash. G. S. Stewart, superintendent of the Wilmar division at Wilmar, Minn., succeeds Mr. Elliott.

C. C. F. Bent, general manager of the Baltimore & Ohio Southwestern, at Cincinnati, Ohio, has been appointed superintendent of the New York division of the Baltimore & Ohio and vice-president of the Staten Island Railway and the Staten Island Rapid Transit Railway, with office at New York, succeeding G. H. Campbell, whose appointment to an executive position is mentioned elsewhere in these columns. Mr. Bent's former position has been abolished, and the duties are assumed by general superintendent W. H. Brimson, who reports direct to Vice-President G. L. Potter. John G. Walber, general superintendent of transportation at Baltimore, Md., has been appointed assistant general manager, and his jurisdiction has been extended over the Baltimore & Ohio Southwestern. C. W. Galloway, superintendent of transportation at Baltimore, succeeds Mr. Walber, and his former position has been abolished.

Robert Stevens Parsons, who has been appointed superintendent of the Erie Railroad, with office at Jersey City, N. J., was born May 26, 1873, at Hohokus, N. J. He was educated at Rutgers College, and began railway work with the Erie Railroad in June, 1895, as a civil engineer on the New York division. About a year later he went to the chief engineer's office, and from 1897 to 1899 was assistant engineer on the Buffalo division. He was then for four years division engineer on the New York, Susquehanna & Western. In 1903 he was appointed engineer of maintenance of way of the Erie, remaining in that position until 1907, when he was appointed superintendent of the Susquehanna division, which position he held at the time of his recent appointment. Mr. Parsons has been a member of the American Society of Civil Engineers since 1906.

Traffic Officers.

P. R. Jarvis has been appointed northwestern freight and passenger agent of the Lehigh Valley, with office at Minneapolis, Minn.

H. D. Hughes has been appointed a traveling freight agent of the Louisville & Nashville, with office at Kansas City, Mo., succeeding J. C. Armstrong, resigned.

E. L. Lomax, general passenger agent of the Union Pacific at Omaha, Neb., has been appointed passenger traffic manager of the Western Pacific, with office at San Francisco, Cal.

D. H. Hillman, general freight and passenger agent of the Evansville & Terre Haute, at Evansville, Ind., has been appointed general southern agent of the Frisco Lines, with office at Nashville, Tenn.

Charles H. Gomm, commercial agent of the Queen & Crescent at Dallas, Tex., has been appointed commercial agent of the Cincinnati, Hamilton & Dayton, with office in the Merchants Loan & Trust building, Chicago.

H. H. Kilpatrick, commercial agent of the Clyde Charleston Fast Freight Line at Nashville, Tenn., has been transferred to Kansas City, Mo. Harry H. Hill, commercial agent of the Macon & Birmingham Ry. at Nashville, succeeds Mr. Kilpatrick. C. J. Orrison has been appointed traveling freight agent at Birmingham, Ala.

W. E. Coman, general freight agent of the Oregon Railroad & Navigation Co. and assistant general freight agent of the Southern Pacific Lines in Oregon, with office at Portland, Ore., has been appointed general freight and passenger agent of the Spokane, Portland & Seattle and the Astoria & Columbia River, succeeding H. M. Adams, resigned.

Engineering and Rolling Stock Officers.

J. F. Killeen has been appointed general mechanical foreman of the Washington division of the Oregon Railroad & Navigation Co., with office at Starbuck, Wash., succeeding M. J. Carrigan, resigned.

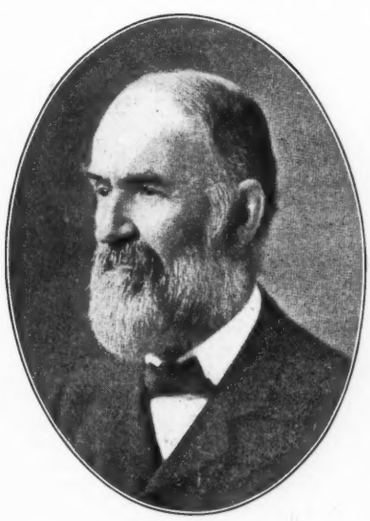
J. D. Harris, general superintendent of motive power of the Baltimore & Ohio, and Earl Stimson, chief engineer maintenance of way, both with offices at Baltimore, Md., have had their authority extended over the Baltimore & Ohio Southwestern.

Special Officers.

Dr. H. A. Beatty has been appointed chief surgeon and medical officer, Eastern lines, of the Canadian Pacific, with office at Toronto, Ont.

OBITUARY.

William H. Brown, formerly chief engineer of the Pennsylvania Railroad, died at Belfast, Ireland, on June 25. Mr. Brown was born February 29, 1836, at Lancaster, Pa. His first railway service was in 1861 as engineer of the United States Military Railway. In 1862 he went to the Pittsburgh, Cincinnati, Chicago & St. Louis as assistant engineer, and in 1863 was promoted to principal assistant engineer. The following year he went to the Pennsylvania Railroad as assistant engineer on the Pittsburgh division, and was appointed engineer of the Philadelphia & Erie division in 1867. Two years later he was put in charge of construction at the Altoona car shops with the title of assistant engineer. He was made resident engineer of the Middle division in 1870, chief engineer and superintendent of the Lewistown division in 1871, superintendent of the Bedford division in 1872, and from 1874 to 1881 he was engineer of maintenance of way. In 1881 he was appointed chief engineer of the Pennsylvania Railroad Company, remaining in that position until his retirement in March, 1906. An appreciation of Mr. Brown's work was published in the *Railroad Gazette* of March 2, 1906, page 198.



William H. Brown.

Railway Construction.

New Incorporations, Surveys, Etc.

Apalachicola Northern.—Passenger service has been extended from Apalachicola, Fla., south to Port St. Jose, 23 miles.

Atchison, Topeka & Santa Fe.—An officer of the Pecos & Northern Texas writes that work is now under way from the Gulf, Colorado & Santa Fe at Coleman, Tex., northwest to Lubbock, 200 miles, also on a branch from the Coleman-Lubbock line, at a point 16 miles southeast of Lubbock, through Lynn and Dawson counties, to La Mesa, 55 miles. In addition, the line from Plainview south to Lubbock, 45 miles, and the line from Plainview east to Floydada, 27 miles, have been turned over to the operating department. (Oct. 8, p. 662.)

Carolina, Clinchfield & Ohio.—The Dumps Creek line has been opened for business from St. Paul, Va., to Hurricane, 12 miles.

Chicago & North Western.—Authority has been granted this company by the Railroad Commission of Wisconsin to build 16 miles of railway in Barron county.

Connellsville & State Line.—See Western Maryland.

El Paso & Southwestern.—An officer writes regarding the reports that this company will probably build extensions, that at the present time the company is simply making preliminary surveys to Tucson, Ariz., and Phoenix, but that nothing definite has been decided upon.

Frontier & Western.—The New York Public Service Commission, Second district, will hold a further hearing on the application of this company for a certificate of public convenience and necessity. The plans call for a line from the terminus of the Frontier Terminal Railway to the International bridge. C. W. Goodyear, president; R. F. Schelling, secretary, Buffalo. (Aug. 13, p. 297.)

Georgia & Florida.—This company will start operating through trains over its own tracks from Madison, Fla., north to Augusta, Ga., on July 1.

Grand Trunk Pacific.—Residents of the section near Weyburn, Sask., have applied to this company to build a line from Regina south to the United States border. An officer writes that the company, at a recent conference with representatives of that section, agreed to make an investigation of the country and build a spur southeasterly, if the amount of business from that territory would justify the expenditure. The projected route is from a point on the branch line which is to be built from Regina southeast to Weyburn.

Gulf, Colorado & Santa Fe.—See Atchison, Topeka & Santa Fe.

Hornell & Bath Interurban.—The New York Public Service Commission, Second district, has authorized this company to issue an additional $195,000 of bonds. The proceeds are to be used for building from Hornell, N. Y., east to Bath, 24 miles. C. Adsit, J. M. Finch, Hornell, and J. F. Turk, Hammondsport, are directors. (Jan. 7, p. 68.)

Marianna & Blountstown.—This road has been opened for business from Marianna, Fla., to Old Blounstown, 29 miles (Nov. 19, p. 991).

Mexican Roads.—The Mexican government has given a concession to V. Mistretta, Galveston, Tex., to build a line in the state of Tabasco. A company is being organized in the United States to carry out the project.

Michigan Central.—A new branch, called the Bagley branch, has been opened for business from Salling, Mich., east to Johannesburg, 14 miles.

National Railways of Mexico.—Plans are being made, it is said, to build a branch from Allende, Coahuila, north to Las Vacas, on the Rio Grande, opposite Del Rio, Tex. An international bridge is to be built over the Rio Grande to connect with a branch of the Kansas City, Mexico & Orient.

New York, New Haven & Hartford.—The New York Public Service Commission, Second district, has authorized the Westchester Northern, a subsidiary of the N. Y., N. H. & H., to issue $60,000 capital stock. The proceeds are to be used to secure a right-of-way for the proposed line. The commission recently authorized the construction of a line in the county of Westchester, N. Y. The line will also extend into Connecticut. (June 10, p. 1437.)

Ontario & Northern.—Preliminary surveys are being made and work is to be started about October 1, on the line from Ontario, Wis., northeast to Wilton, eight miles. There will be about four steel bridges each 40 ft. long. E. Stackman, president; V. A. Stoddard, secretary, and A. E. Rau, engineer, Ontario. (June 24, p. 1813.)

Pecos & Northern Texas.—See Atchison, Topeka & Santa Fe.

Pine Bluff & Northern.—An officer writes that surveys are not yet finished but that the company expects to let contracts and begin work early in August. The projected route is from Pine Bluff, Ark., north to Searcy, about 80 miles, with a branch west to Little Rock, about 25 miles. There will be one steel bridge. W. J. Miller, president, Lamar, Mo., and F. C. Kyte, engineer, Carlisle, Ark. (June 17, p. 1568.)

Pittsburgh & Fairmont.—According to press reports, this company is planning to operate a double-track line about 120 miles long, between Pittsburgh, Pa., and Fairmont, W. Va. It is understood that the Wabash Pittsburgh Terminal tracks will be used from Bridgeville for an entrance into Pittsburgh. W. M. Laws, president, New York.

St. Louis Southwestern.—An officer writes that the 43-mile line of the Stephenville North & South Texas, from Stephenville, Tex., south to Hamilton, is now owned by this company. Work is now under way building an extension from Hamilton, southeast to Gatesville, 32 miles. Thompson & Scott, Wainwright building, St. Louis, Mo., are the contractors. There will be a three-span steel bridge over the Leon river. (April 29, p. 1115.)

San Antonio & Aransas Pass.—An officer is quoted as saying that new track is to be laid on the line between Houston, Tex., and Yoakum; Kenedy and Skidmore, and Yoakum and Moulton. Orders are now being placed for rail to be used on the first 100 miles for early delivery.

Seaboard Air Line.—An officer writes that a contract has been given to E. L. Anderson & Co., Dunnellon, Fla., for building an extension from Fruitville north to Venice, 18 miles. Clearing and grading for an extension from Nichols east to Mulberry is finished and some track has been laid. (April 15, p. 1017.)

Southwestern.—This road has been extended from Scotland, Tex., to Archer City, 10 miles (Jan. 21, p. 165).

Stamford & Eastern.—This company is said to have completed its organization in Texas, and will at once begin work on a line from Stamford, Tex., east to the coal fields, about 60 miles. An officer is quoted as saying that financial arrangements have been made. W. T. Andrews, president. The directors include R. V. Colbert, F. S. Hastings, C. Brewington and T. M. Richardson, all of Stamford.

Stephenville North & South Texas.—See St. Louis Southwestern.

Texas Central.—An officer writes that grading is about 75 per cent. finished and track laying is now under way on the branch from De Leon, Tex., westerly through Sipe Springs and Rising Star to Cross Plains, 41 miles. It is expected to have the line finished in time to carry this year's crops. Five thousand tons of 80-lb. open hearth rail is now being delivered, which will be laid on the main line to replace lighter sections. Nothing has been done on the proposed extension from Rotan, Tex., west except to make one or two preliminary surveys. (April 29, p. 1115.)

Union Pacific.—The Greeley branch has been opened for operation from Greeley, Colo., to Briggsdale, 28 miles.

Wabash Pittsburgh Terminal.—See Pittsburgh & Fairmont.

Westchester Northern.—See New York, New Haven & Hartford.

Western Maryland.—Construction work has been started near Connellsville, Pa., on the Connellsville & State Line, which is to build a section of the line to connect the Western Maryland at Cumberland, Md., with the Pittsburgh & Lake Erie at Connellsville. (June 10, p. 1438.)

Railway Financial News.

ALBUQUERQUE & EASTERN.—See New Mexico Central.

BRINSON.—The Brinson Railroad Co., which recently took over the Savannah Valley, has been authorized by the Georgia Railroad Commission to issue $1,000,000 of common stock, $500,000 of preferred stock, and $420,000 in bonds, the proceeds of which are to be used for retiring the indebtedness of the Savannah Valley road and to make improvements.

CHICAGO, CINCINNATI & LOUISVILLE.—The road was sold at foreclosure at Richmond, Ind., on June 23 for the upset price of $5,200,000, to interests identified with the Chesapeake & Ohio. These interests were the only bidders.

CHICAGO, PEORIA & ST. LOUIS.—The secretary of the organization committee has sent out a circular explaining that the delay in the completion of reorganizing the company under the plan declared effective October 6, 1909, was due to the fact that the committee believes that the best interests of the security holders would be preserved by awaiting the determination of a suit brought by the receivers in the federal court to restrain the enforcement of the Illinois two-cent fare law. The state has been allowed until July 1, 1910, to submit testimony, and it is hoped that a decision will be given shortly thereafter. As soon as this is done the committee expects to carry out the reorganization as provided in the plan and agreement of July 7, 1909.

CUBA RAILROAD.—A dividend of 2 per cent. has been declared on the $10,000,000 6 per cent. non-cumulative preferred stock, payable August 1. This compares with 1½ per cent. paid in February, 1910, and 1½ per cent. paid in August, 1909.

HOCKING VALLEY.—Judge Lacombe in the United States circuit court at New York has allowed the discontinuance of the suit brought by H. Raymond Munger against this company, J. Pierpont Morgan and other members of the firm of J. P. Morgan & Co. The suit had been brought by Mr. Munger, a holder of preferred stock, to enjoin the company from taking any further steps in regard to reorganization of combination with the Kanawha & Michigan or the Chesapeake & Ohio, and also to prevent a further contemplated issue of common stock. It was charged that when the Hocking Valley transferred $15,000,000 to J. P. Morgan & Co. it relinquished all claim upon that amount, and that a voting trust was formed, the $15,000,000 payment effecting a specific appropriation for the redemption of its preferred stock and the railway thereby parting with all ownership of it. Under injunction Morgan & Co. refused to redeem the preferred stock, but upon dissolution of the injunction redemption was resumed and nearly $12,000,000 out of a total of $15,000,000 of the preferred stock has been turned over to them.

This company, the Lake Shore & Michigan Southern and the Kanawha & Michigan have filed suits against D. H. Gould and J. S. Stanton, minority stockholders of the Kanawha & Michigan, and against three minority stockholders of the Hocking Valley to recover $1,000 from Gould and Stanton and $36,000 from Schoendinger, Westfall and Mannington for dividends which the company was compelled to pay on the $15,000,000 preferred stock during the time that the company was prevented from retiring this stock by injunctions obtained by the defendants.

MIDLAND VALLEY RAILROAD.—Holders of the $5,980,000 Midland Valley Railroad 5 per cent. bonds and of the $1,650,000 Cherokee Construction Co., 5-year 6 per cent. notes are asked to deposit their securities with Drexel & Co., Philadelphia, under a plan to relieve the railway from burdensome car trust payments. Under the plan the railway will issue $6,000,000 prior lien 5 per cent. bonds secured on the rolling stock, and by collateral on the coal estate of the Construction Company as well as on the railway, and $1,800,000 6 per cent. 2½-year notes, to be secured by $2,500,000 general consolidated 6 per cent. bonds. According to the terms of the plan, each $1,000 bond now out will be exchanged for $711.11 new bonds and $168.48 new railway notes, and each $1,000 Construction Company note now out will be exchanged for $844.44 new bonds and $200 in railway notes.

MINNEAPOLIS & ST. LOUIS.—The directors have decided to omit the regular semi-annual dividend of 2½ per cent. on the $4,000,000 5 per cent. non-cumulative preferred stock due February 15. The annual rate paid since 1899 has been 5 per cent. The official statement of this decision explains that the passing of the dividend is caused by the peculiarly adverse circumstances, including the strike of the switchmen in the Northwest, undergone by the Minneapolis & St. Louis since December 1, 1909.

NEW MEXICO CENTRAL.—A foreclosure suit has been filed under the mortgage on the road partly built from Moriarty, N. Mex., to Albuquerque, 45 miles, and on the Hogan coal fields, made by the former Albuquerque & Eastern.

NEW YORK CENTRAL & HUDSON RIVER.—J. P. Morgan & Co., the First National Bank and the National City Bank, all of New York, are offering $22,500,000 4½ per cent. New York Central Lines equipment trust certificates of 1910 at a price to yield over 4⅝ per cent. on the investment. The total authorized issue is $30,000,000, dated January 1, 1910, and due $1,500,000 issued bonds and $500,000 unissued bonds yearly from 1911 to 1925.

NEW YORK, ONTARIO & WESTERN.—T. De Witt Cuyler has been elected a director, succeeding Charles S. Whelen, deceased. Mr. Cuyler was recently elected a director of the New York, New Haven & Hartford, which controls the Ontario & Western, to act as an additional representative of the Pennsylvania Railroad on the New Haven board.

NORTHERN CENTRAL.—The *Philadelphia Ledger* says that the fact that the Moore-Hambleton and the Townsend-Scott committees, both representing minority stockholders, cannot get together, appears to be the chief obstacle in the way of an early conclusion of the negotiations now going on for a lease of the property to the Pennsylvania Railroad.

ST. LOUIS & SAN FRANCISCO.—A syndicate headed by Wm. Salomon & Co., New York, and G. H. Walker & Co., St. Louis, which syndicate recently bought $6,000,000 new New Orleans, Texas & Mexico division first mortgage bonds and had an option on $10,000,000 additional, has made negotiations for the sale of this additional $10,000,000 bonds in Paris, where they are offered, it is understood, by the Banque de l'Union Parisienne and the Credit Mobilier Francais in denominations of 516 francs (about $100). The $6,000,000 issue of bonds are 5 per cent. bonds, but the $10,000,000 bonds sold abroad are 4½ per cent. bonds.

SEABOARD AIR LINE.—The directors have declared the payment in full of the first semi-annual 2½ per cent. interest, due August 1, on the $24,979,500 adjustment 5 per cent. income bonds.

SOUTHERN PACIFIC.—Kuhn, Loeb & Co., New York, offered for subscription up to June 24 $25,000,000 San Francisco terminal first mortgage 4 per cent. bonds of 1910-1950. This offering is made simultaneously with offerings of these bonds in Berlin, Hamburg, Frankfort-o-M, London, Basel, Zurich, Amsterdam and also in Boston, San Francisco, Los Angeles and Portland, Ore. The bonds are secured by a first mortgage on the so-called Bay Shore Line and other railway property, comprising the terminals owned by the Southern Pacific in the city of San Francisco. The total authorized issue under the mortgage is $50,000,000, of which $25,000,000 are reserved to be issued for the acquisition of additional real estate for the building of branches or extension of the road covered by the mortgage and for the improvement and betterment of the property. It is understood that about $5,000,000 of the offering were subscribed for in this country. (June 17, 1910, p. 1570.)

A press despatch from Mexico City says that when the Southern Pacific tracks are completed to Orendain, it will arrange for trackage rights into Guadalajara over the National Railways of Mexico.

WABASH-PITTSBURGH TERMINAL.—A new protective committee of first mortgage bondholders has been organized consisting of James G. Chaplin, chairman; William B. Nicholson, C. L. Harper, Meigs H. Whaples and Richard Sutro.

Supply Trade Section.

William L. Austin has been made president of the Baldwin Locomotive Works, succeeding John H. Converse, deceased. Mr. Austin has been chief draftsman of the company.

The Asbestos Protected Metal Co., Canton, Mass., has recently opened an office at 100 Broadway, New York. P. M. Stewart, formerly building commissioner of New York, is resident manager.

The directors of the T. H. Symington Co., Baltimore, Md., have placed the cumulative preferred stock on a semi-annual dividend basis instead of quarterly as heretofore, so that the quarterly dividend of 1¾ per cent. will not be paid on July 1.

The Northern Engineering Works, Detroit, Mich., crane builders, reports that it has recently installed, in the power stations of the Tunnel & Terminal Ry. Co., New York, two 25-ton, 40-ft. span traveling Northern cranes, and also one of 10 tons capacity.

At the election of officers of the Crocker-Wheeler Company, Ampere, N. J., the following were elected for the ensuing year: President, Schuyler Skaats Wheeler; first vice-president, Gano Dunn; third vice-president, Arthur L. Doremus; chief engineer, Gano Dunn; secretary, Rodman Gilder, and treasurer, W. L. Brownell.

At the M. C. B. and M. M. conventions at Atlantic City, N. J., the Joliet Railway Equipment Company, Joliet, Ill., exhibited two sets of the Perry side bearings. One of these sets made a record of 300,000 miles and the other 400,000 under the cars of the Chicago & North Western Overland Limited trains. The bearings were in splendid condition after this service.

The Universal Portland Cement Co., Chicago, has authorized the construction of the 4,000,000 barrel plant at Buffington, Ind., as planned. In January, 1910, the construction of the first half of the plant, to have an annual capacity of 2,000,000 barrels, was authorized, but now a decision has been reached to increase the capacity of the plant as soon as possible. This construction will cost about $4,500,000, and when completed will give the company a yearly output of 8,000,000 barrels at the Buffington plant and 12,000,000 total.

The Bucyrus Company, South Milwaukee, Wis., has acquired the exclusive rights to make and sell the Heyworth-Newman drag line excavators, formerly owned by James O. Heyworth, Chicago. The Heyworth bucket is designed with a rigid bail which can be adjusted so that it will actually dig the material rather than scrape off thin layers of it, and its shape is such that it clears itself in dumping even in extremely sticky material. It is claimed that the machine can dig practically any material which a steam shovel can handle, and it is believed that it will successfully meet the demand for canal, irrigation ditch, and certain classes of railway construction work. Three of the machines are now at work on the North Shore drainage canal of the Chicago Sanitary district and others are being used on the New York State barge canal, the Cape Cod canal, and in various other places.

David Van Alstyne has been elected vice-president in charge of manufacture of the Allis-Chalmers Company, with headquarters at Milwaukee, Wis. Mr. Van Alstyne is specially well fitted for this work, and is one of the few men who understand thoroughly, and know how to apply successfully, the principles underlying economical and efficient production on a large scale. He was born in Louisville, Ky., June 14, 1865, and was graduated from the Massachusetts Institute of Technology in 1886. He became a machinist's apprentice on the Louisville & Nashville, and remained with that road for eight years in the machine shop and as a locomotive fireman and an engine house foreman. For three and a half years he was engaged in the foundry business in Louisville, after which he was for one year a master mechanic on the Louisville, Henderson & St. Louis. In 1899 he went with the Chicago Great Western as a division master mechanic, but was shortly afterward made superintendent of motive power, remaining in that position until May, 1904, when he accepted a position as mechanical superintendent on the Northern Pacific. His splendid work on these two roads attracted attention to his qualities as an executive and manager, and in 1907 he was elected vice-president in charge of manufacture of the American Locomotive Company. During the past few months he has been retained in a consulting capacity for a western railway system.

L. R. Pomeroy, assistant to the president of the Safety Car Heating and Lighting Company, New York, has resigned to take a position with J. G. White & Co., Inc., New York, as chief engineer of its railway and industrial division. Mr. Pomeroy has for a long time been considered an authority on railway shop equipment, operation and construction, and is peculiarly adapted both by nature and training for his new work. He was born at Port Byron, New York, in 1857, and attended high school at Milwaukee and the Irving Institute at Tarrytown. From 1874 to 1880 he was engaged in commercial business, bookkeeping, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company of New York. For four years following this, he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company, jointly; this assignment involved metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1899 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads, railway shops, and the general application of electricity for all railway purposes. For the past two years he has been assistant to the president of the Safety Car Heating and Lighting Company. In connection with this he has devoted a portion of his time in consulting work in the special field of railway shops, machine tool operation and the adaptation of tools to the work, with special reference to sequence of operation and general efficiency.

TRADE PUBLICATIONS.

Concrete Repair Shop Buildings.—The Arnold Co., Chicago, is sending out mailing cards with four photographs of concrete buildings for railway repair shops built by that company.

Chicago, Burlington & Quincy.—The Burlington is sending out mailing cards announcing the new daily tourist sleeper service from St. Louis and Kansas City to Denver. The personally conducted through cars are especially emphasized.

Coal Mining Plants and Washeries.—The Roberts & Schaefer Company, Chicago, has issued Bulletin No. 20 which contains photographs and data regarding 18 coal mining plants and coal washeries which this company has recently completed.

Steel Derricks and Drilling Machines.—The Carnegie Steel Company, Pittsburgh, Pa., has just issued a pamphlet containing a large amount of useful information regarding its steel derricks and drilling machines for oil, gas, salt and other wells.

Idaho & Washington Northern.—"Spokane's Vacation Land" is the title of a booklet describing the mountain, lake and river resorts on the Pend Oreille River Route. The illustrations are reproduced in color and the descriptive matter is interesting reading.

Michigan Central.—"Nearby Resorts" is the title of a 20-page booklet by the passenger department of the Michigan Central, describing outing points near Chicago. Descriptive matter, maps, lists of hotels and other general information is included. A card is also being distributed advertising a new Saturday train to Diamond Lake, Barron Lake, Corey Lake, Fisher Lake and other nearby resorts.

Great Northern.—The passenger department of the Great Northern is distributing a mailing card calling attention to the new Glacier National Park in northwestern Montana, which is reached by the three daily transcontinental trains of that road. Another publication by the same company is a folder on its international train, the Winnipeg Limited, between St. Paul, Minneapolis and Winnipeg.

Chicago, Rock Island & Pacific.—A large folder is being widely distributed by the passenger department of the Chicago, Rock Island & Pacific to encourage the "see America first" spirit in summer tourists. An editorial from the Boston *American* of February 19, 1910, is reproduced, five views of American scenery are shown, and a few brief arguments in favor of seeing America first are presented.

Great Northern.—The Great Northern issued a booklet descriptive of St. Paul's business interests on the occasion of the annual up-State excursion of the St. Paul Jobbers and Manufacturers' Association, June 12-19. The Great Northern furnished a special train for this trip and the greater part of the itinerary was over the lines of that company. The booklet includes a number of photographs and reproduction of a painting of the city from across the river.

Chicago, Burlington & Quincy.—The "Colorado and Utah Handbook" is the title of a 26-page booklet issued by the passenger department of the Chicago, Burlington & Quincy. In addition to general illustrations and descriptions of that region, a list of rivers in which to fish, a digest of the game and fish laws, and an alphabetical list of hotels and boarding houses are included. The department is sending out with this booklet an advertisement of a 72-page book on "Scenic Colorado" which will be sent for five two-cent stamps.

Northwestern Line.—The passenger department of the Chicago and North Western has issued a folder showing the through route from Chicago to Lake Geneva, with complete service. Another folder gives colonist rates to the West and Northwest. "The Fisherman's Special" is a booklet giving the schedule of the special train on the Chicago & North Western to the fishing resorts of Wisconsin and Michigan. A special schedule of the "Los Angeles Limited" has been issued. The running time of this train has been reduced to 68½ hours.

Electrical Equipment.—The General Electric Co., Schenectady, N. Y., in bulletin No. 4,730 describes its single-truck type of gas-electric motor car; in bulletin 4,732 its Curtiss steam turbine-generators of various capacities; in bulletin No. 4,736 various types of lightning arresters for alternating and direct current, both high and low voltage circuits; in bulletin No. 4,737 an electric hardening surface, designed for hradening or tempering tool steel; in bulletin No. 4,738 three sizes of polyphase, 60-cycle, belt-driven revolving armature type generators for use in small isolated plants; in bulletin No. 4,739 the G E Mazda incandescent lamp with an improved tungsten filament; in bulletin No. 4,740 line drop compensators for alternating-current circuits; in bulletin No. 4,741 luminous arc lamps for direct-current multiple circuits, and in bulletin No. 4,744 meter testing rheostats.

RAILWAY STRUCTURES.

AUGUSTA, GA.—An officer of the Georgia & Florida writes that about July 1 work on a brick warehouse now being remodeled by the company's men at Washington, Twiggs and Calhoun streets, in Augusta, will be finished. The building is to be one-story high, 370 ft. x 370 ft.

DU BOIS, PA.—See Springville, N. Y.

FORT WAYNE, IND.—Plans, it is said, are being made by Philadelphia architects to put up a union station in Fort Wayne at a cost of $1,000,000, to be used jointly by the Pennsylvania Railroad, Wabash and Lake Shore & Michigan Southern. (June 24, p. 1815.)

GALVESTON, TEX.—The Galveston-Houston Interurban Railway is said to have bought land in Galveston to be used as a site for shops and car buildings.

HAMMOND, IND.—Improvements to be made by the Baltimore & Ohio in Lake county, it is said, call for an expenditure of more than $5,000,000.

HOLDREDGE, NEB.—The Chicago, Burlington & Quincy is building a new coaling station to cost about $20,000. As soon as this is completed work on the new station mentioned in the *Railway Age Gazette* of May 20 will be begun.

HOUSTON, TEX.—Plans are being made by the Galveston-Houston Interurban Railway for a new passenger station to be built in Houston. An officer of the Stone & Webster Engineering Corporation writes that no definite conclusion has yet been reached regarding the construction of the building and they are unable to furnish information at the present time.

JEFFERSONVILLE, IND.—The Pennsylvania Railroad is preparing to rebuild the bridge over the Ohio river at this place, it is said, at a cost of $3,000,000.

LAFAYETTE, LA.—Bids are wanted by the Morgans, Louisiana & Texas for putting up a new brick and slate passenger station at Lafayette.

LINCOLN PARK, N. Y.—See Springville, N. Y.

LOUISVILLE, KY.—The Kentucky & Indiana Bridge & Railroad Co. will give a new mortgage, it is said, to secure funds for building a new double-track bridge over the Ohio river at Thirty-first street, Louisville. The new bridge is to have eight large stone piers and eight spans; two of the spans will be 620 ft. long. It will require about two years to complete the structure.

MEMPHIS, TENN.—An officer of the Louisville & Nashville writes that a contract has been given to the Murch Brothers Construction Co., St. Louis, Mo., and work is to be started by July 1 on a union passenger station at Calhoun street in Memphis. The building is to be 83 ft. x 283 ft., with express room 40 ft. x 200 ft. and a concourse 75 ft. x 283 ft. The station will be constructed of brick, faced with granite and limestone, and is to be used by the Louisville & Nashville, the Nashville, Chattanooga & St. Louis, the Southern Railway, the Missouri Pacific and the St. Louis Southwestern. (Dec. 17, p. 1218.)

MINNEAPOLIS, MINN.—An officer of the Great Northern writes that orders have been given to the Wisconsin Bridge & Iron Co. for fabricating the superstructures to replace old bridges at Fifteenth avenue and Fourth street, and University avenue between Thirteenth and Fourteenth streets, in S. E. Minneapolis. Contracts for the erection and substructure have not yet been let.

PETERSBURG, VA.—According to press reports the Seaboard Air Line is making plans for putting up a new passenger station in Petersburg.

SACRAMENTO, CAL.—The Western Pacific has let the contract for building a machine shop, 138 ft. x 221 ft. According to press reports, work is to begin at once.

SALT LAKE CITY, UTAH.—The Utah Light & Railway has begun work on a machine shop and car plant as an addition to its present shops.

SAN ANTONIO, TEX.—The San Antonio & Aransas Pass, it is said, has under consideration the question of putting up a passenger station at San Antonio.

SPOKANE, WASH.—The Chicago, Milwaukee & Puget Sound is said to have bought 72 acres of land near Spokane, which will be used as a site for car shops, roundhouses and side tracks.

SPRINGVILLE, N. Y.—An officer of the Buffalo, Rochester & Pittsburgh writes that a contract has been given to L. J. Shuttleworth for building a brick and stone passenger station at Springville, also that a contract has been given to the Otto Gas Engine Works, Chicago, for the erection of a bucket type mechanical coaling station of 500 tons storage capacity at Lincoln Park, N. Y., as well as a similar station of 1,200 tons storage capacity at Du Bois, Pa.

SUNBURY, PA.—The Sunbury & Northumberland Electric Railway Company is to pay $17,000 towards the cost of a new bridge to be built at Sunbury.

YOAKUM, TEX.—The San Antonio & Aransas Pass will put up two new shop buildings, it is said, at Yoakum.

Late News.

The items in this column were received after the classified departments were closed.

G. B. Wall, real estate agent of the Chesapeake & Ohio at Richmond, Va., has been appointed assistant to the president, and will, in addition to his duties as real estate agent, perform such other duties as may be assigned to him.

A press despatch from St. Louis, Mo., which St. Louis Southwestern officials in New York will neither confirm nor deny, says that the Louisville & Nashville has made arrangements to obtain control of the St. Louis Southwestern, and that the arrangements for the transfer of control of this Gould property to the Louisville & Nashville interests will be completed within 30 days. The despatch states that the cash cost to the Louisville & Nashville will be about $1,500,000.

The Interstate Commerce Commission on June 29 handed down its decisions in the so-called Pacific coast cases, and in almost every instance ordered substantial reductions in nearly all the cases complained of. The cases decided by the commission are the Traffic Bureau of the Merchants Exchange v. Southern Pacific, opinion by Commissioner Lane; City of Spokane v. Northern Pacific, opinion by Commissioner Prouty; Maricopa County Commercial Club v. Santa Fe, Prescott & Phoenix, opinion by Commissioner Lane; Portland Chamber of Commerce v. Oregon Railroad & Navigation Co. and the Transportation Bureau of the Seattle Chamber of Commerce v. the Northern Pacific, opinion by Chairman Knapp; Railroad Commission of Nevada v. the Southern Pacific, opinion by Commissioner Lane; and the Commercial Club of Salt Lake City v. the Atchison, Topeka & Santa Fe, opinion by Commissioner Prouty.

The Spokane case, which has been before the commission before, and in which the railways were asked to submit new schedules of rates, holds that the schedules submitted by the railways are unreasonable, and that the new rates are excessive. The rates established by the commission, effective October 1, are much lower on both class and commodity freight. Railways are required to furnish detailed accounts during July, August and September, showing the revenue which has been earned on business handled under present rates and the revenue which would have been earned on the same amount of business if the rates now prescribed by the commission had been in effect.

In the Salt Lake City case the present class rates in both directions between Chicago, Mississippi river and the Missouri river, on the one hand, and Utah common points on the other, are found unreasonable, and materially lower rates are prescribed; and western commodity rates from eastern points of origin to Utah common points are also found unreasonable, and reduced rates are prescribed. Rates on fruit from California are found unreasonable and lower rates are prescribed. Defendants are ordered to establish to Utah points proportional import rates on certain articles which do not exceed those in force to the Missouri river, and the present rates on sago, tapioca, tea and tea dust found unreasonable to the extent that they exceed those now in effect to Missouri river points. Present passenger fares between Utah common points and Ogden, Utah, and Portland are not found unreasonable, but the rates between Salt Lake City and Los Angeles and San Francisco, and between Ogden and Provo and San Francisco are found unreasonable.

In the Nevada case, class rates in eastern territory to Nevada found unreasonable, and reasonable rates are prescribed.

In the Merchants Exchange case, class rates from Sacramento, Cal., to points on the main line of the Southern Pacific between Reno, Nev., and Cecil Junction, Utah, are found unreasonable, and lower rates are prescribed.

In the Maricopa case class rates from points in eastern territory between the Missouri river and the Pittsburgh-Buffalo line to Phoenix, Ariz., are found unreasonable, and lower rates are prescribed.

In the Portland and Seattle case, class rates from Seattle, Tacoma and Portland to points in Washington, Oregon, Idaho and Montana are found unreasonable, and a reduction of 20 per cent. in these rates is proposed. In no one of the cases was there a dissenting opinion.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Oregon Electric has ordered one electric locomotive from the American Locomotive Co.

The Chesapeake & Ohio is said to be asking prices on 10 locomotives. This item is not confirmed.

The Chicago & Alton is said to be in the market for a number of locomotives. This item is not confirmed.

The New York, New Haven & Hartford has ordered two Pacific passenger locomotives from the American Locomotive Co.

The Chicago, Indianapolis & Louisville has ordered five consolidation freight locomotives from the American Locomotive Company.

CAR BUILDING.

The Chicago & Alton is said to be in the market for 60 passenger cars. This item is not confirmed.

The Metropolitan Street Railway, Kansas City, Mo., reported in the *Railway Age Gazette* of May 13 as being in the market for 25 electric cars, has ordered this equipment from the Cincinnati Car Company.

The Baltimore & Ohio, previously reported as being in the market for freight equipment, has ordered 1,000 coke cars from the Pressed Steel Car Company and 1,000 coke cars from the Cambria Steel Company. This company has also added 1,000 composite gondola cars to its inquiries.

The Georgia Railroad, reported in the *Railway Age Gazette* of June 3 as being in the market for 65 box, 25 coal and 10 stock cars, has placed the orders for the special equipment required for these cars, and they will be built in the shops of the company at Augusta, Ga.

MACHINERY AND TOOLS.

The Baltimore & Ohio has ordered a 300-k.w. synchronous motor-generator set for operating ore unloaders at its new ore dock at Loraine, Ohio. The set will receive alternating current at 440 volts, three-phase, 60 cycles, and deliver direct current at 250 volts.

The Chicago, Burlington & Quincy, reported in the *Railway Age Gazette* of January 7, 1910, as in the market for 30 to 40 machine tools, has revived this inquiry and is now reported as taking prices on 100 tools to cost about $200,000. This equipment is for the shops at Havelock, Neb.

IRON AND STEEL.

The San Antonio & Aransas Pass.—See this company under Railway Construction.

The Bangor & Aroostook has ordered 5,500 tons of rails from the Pennsylvania Steel Co.

The Boston & Maine has ordered 350 tons of bridge steel from the Phoenix Iron Works.

The Chicago, Peoria & St. Louis has ordered 1,000 tons of rails from the Lackawanna Steel Co.

The New York, New Haven & Hartford is said to have ordered 2,000 tons of heavy section rails from the Pennsylvania Steel Co.

The New Orleans, Mobile & Chicago is said to have ordered 550 tons of rails from the Tennessee Coal, Iron & Railroad Company.

The Great Northern has ordered steel for bridges from the

Wisconsin Bridge & Iron Co. (See Minneapolis, Minn., under Railway Structures.)

The Texas City Transportation Co., Texas City, Tex., has ordered 400 tons of structural steel for unloading bridges from the American Bridge Co.

The Western Maryland is said to have issued specifications for 18,000 tons of the 30,000 tons of bridge work required for the extension to Connellsville, Pa.

General Conditions in Steel.—Unfavorable crop condition reports from the West and Northwest have had the effect of holding down steel orders. There is a feeling, however, that in event of these reports proving exaggerated, that steel orders in July will show an increase over the month just closed. The steel companies are reported to be receiving orders at about 65 per cent. of capacity and that operations are at present running on an 80 per cent. basis. Sales of pig iron for the first half of this week are estimated at about 50,000 tons.

Inter Ocean Steel Tire.

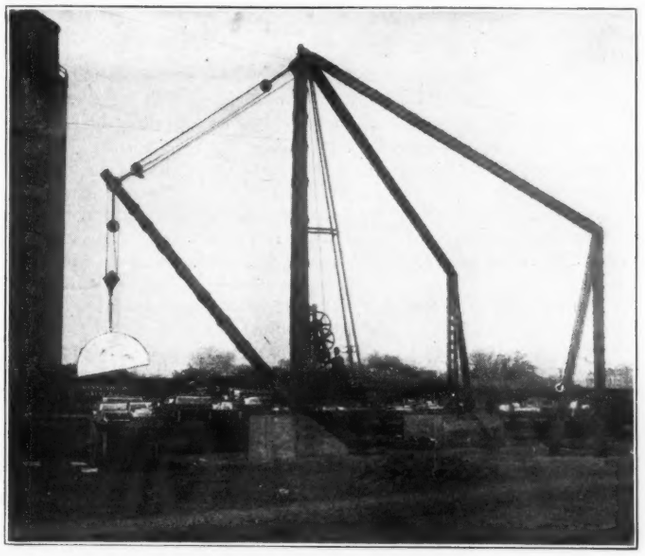
The Inter Ocean Steel Company broke ground for its plant at Chicago Heights, Ill., April 24, 1909; poured the first steel from its open hearth furnaces on April 20, 1910, and rolled the

First Steel Tire Rolled by the Inter Ocean Steel Company.

first tire on June 14, 1910. The illustration is a reproduction of a photograph of this tire and, as can be seen, it is a perfect arc. In fact, it was shipped with the first lot of tires sent out from the works for use on one of the large railway systems of this country.

Freight Derrick.

The Minneapolis, St. Paul & Sault Ste. Marie is installing large capacity derricks at freight houses in order to handle heavy freight that would otherwise have to be refused. The accompanying cut shows the derrick installed on the unloading platform at the Minneapolis (Minn.) freight depot. This derrick has a capacity of 15 tons; the mast is 40 ft. high and the boom 30 ft. The three motions, raising and lowering load, raising and lowering boom, and swinging, are performed by electric power taken from an a.c. circuit. The motor is a General Electric a.c. motor, ITC-5009, 22-h.p., variable speed, direct connected to the hoist. The hoist has two drums operated by the "American" friction clutch, and a swinging or slewing attachment operated by rolling, reversing frictions, through gearing to a bull gear 8 in. in diameter. All the machinery is located on a platform attached to the mast, and all operating levers are banked in a convenient location. The electric power is delivered from an underground cable up through the mast foundation to contact rings above the mast pivot. The use of these contact rings allows the boom to swing freely, and as the



Freight Derrick, M. & St. P. & S. Ste. M.; Minneapolis, Minn.

stiff legs are arranged to allow the boom to swing under them, any number of complete revolutions of the boom in either direction can be made. A hand power double drum crab is mounted on the back of the mast, to be used in case the electric power is cut off. The foundations are of concrete, and are made large enough to withstand the high overturning forces. This derrick was furnished by the American Hoist & Derrick Company, St. Paul, Minn.

History of the Rock Drill.

W. L. Saunders, president of the Ingersoll-Rand Co., New York, with which company he has been connected for 30 years, writes the following interesting summary of the development of drills of this nature:

The rock drill was conceived and developed in the United States by J. J. Couch, an American, of Philadelphia, Pa., who took out the first practical patents in 1849. In his experiments he was assisted by Joseph W. Fowle. The Couch drill was a crank-and-fly-wheel machine. Couch and Fowle separated in 1848, the latter filing a caveat in 1849 covering a drill of his own invention and describing the successful power rock drill substantially as it is to-day. The most important feature of Fowle's drill was that the cutting tool is attached directly to the piston, so that the steel leading into the hole was an extension of the drill piston rod.

Fowle described his invention in his testimony before the Massachusetts legislative committee in his contest with Burleigh in 1874 as follows: "My first idea of driving a rock drill by direct action came about in this way: I was sitting in my office one day after my business had failed, and happening to take up an old steam cylinder, I unconsciously put it into my mouth and blew the rod in and out, using it to drive some tacks with which a few circulars were fastened to the wall."

The nearest approach to rock drill invention abroad was the work of a German, Schumann, in 1854. Fowle being without means to develop his ideas, they remained in obscurity until Charles Burleigh purchased his patents and produced the Burleigh drill about 1866. This drill was used in driving the Hoosac tunnels in Massachusetts in 1867.

Following Couch, Fowle and Burleigh were Haupt, Wood, Ingersoll, Sergeant, Waring and Githens. Githens was the inventor of the Rand drill. The Ingersoll drill was invented in 1871 by Simon Ingersoll, a modest, ingenious and honest me-

chanic, who went to New York from Connecticut, taking with him models of several inventions. He was riding in a New York horse car one day and describing one of his inventions to a fellow passenger. Another passenger in the car, John D. Miner, overheard Ingersoll's conversation. Miner was a contractor, engaged with a gang of men on some rock excavation in New York. He joined the conversation, saying that he had men striking a steel with a hammer in making holes for blasting, but that they could drill only about 10 ft. of hole per day. Ingersoll said that he could make a machine for doing this work if he had the money. Miner gave him $50 and his card, saying that he would give him another like amount if he needed it.

Ingersoll's first rock drill was built in a shop at Second avenue and Twenty-second street, New York City, owned by J. F. de Navarro, and managed by Sergeant and Cullingworth. The Ingersoll Rock Drill Co. was organized by Navarro, who, on Sergeant's advice, purchased all the rights and patents held by Ingersoll. The Ingersoll drill was thereafter made with the separate front head as used to-day. Litigation arose with Burleigh, of Massachusetts, who owned the rights of Fowle and others, which resulted in Navarro purchasing all of the patents for the Ingersoll Rock Drill Co.

The business soon returned to Mr. Navarro the $10,000 which he had paid into it, and in later years he sold his interests to W. R. Chappin for $525,000. Sergeant sold out, due to friction with the management, and went West to engage in mining, but returned to New York about 1885 and organized the Sergeant Drill Co.

Early in the rock drill development the Rand brothers, Addison C. and Gasper R., had become interested through their connection with the Laflin & Rand Powder Company. Addison C. Rand formed the Rand & Waring Drill & Compressor Company, which was later controlled by Rand and merged with the Rand Drill Co., established in 1871 and incorporated in 1879. J. C. Githens, superintendent of the Rand Drill Co., invented the Little Giant rock drill. He was the originator also of many improvements, notably the double-screw column with column arm, which made practical the application of the rock drill to mining and tunneling.

The Sergeant & Cullingworth Co., manufacturing the Ingersoll drill; the Sergeant Drill Co., and the Ingersoll Rock Drill Co. were merged into the Ingersoll-Sergeant Drill Co. Later the Rand Drill Co. and the Ingersoll-Sergeant Drill Co. were consolidated in the Ingersoll-Rand Co., to-day carrying on the business of all these pioneer concerns. The Rand drill was from the beginning the most formidable competitor of the Ingersoll and Sergeant types. The conjunction of the Ingersoll-Sergeant and Rand companies, therefore, was a combination of valuable patents in rock drills, compressors and general machinery for mining, tunneling and quarrying. Each shop received the benefit of the experience of all the others, and the best features of the Ingersoll, Sergeant and Rand types were taken to make an improved product.

The present Ingersoll-Rand Co., New York, capitalized at $10,000, sells its products throughout the world. Its machines are recognized standards in their line and its constant endeavor is to maintain high standards.

British Telephone System.

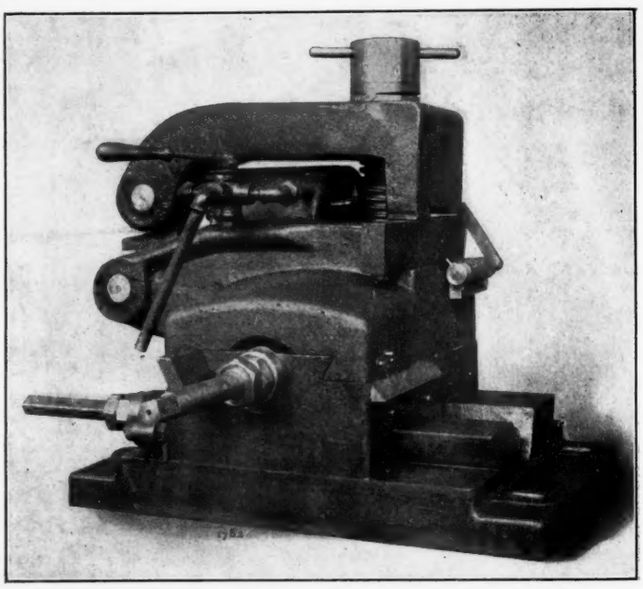
The fact that about two years hence the British post office is to take over and nationalize the entire telephone system of the United Kingdom makes pertinent a review of the results which have been attained in 40 years of a government monopoly of the telegraph system. When the British telegraphs were nationalized, in 1870, it was confidently estimated that the service would be self-supporting and more; but the 40 years of operation show a total deficit of nearly $87,500,000 for interest, for capital expenditures, and for excess cost of operation over receipts. In other words, more than $2,000,000 a year has been taken from the pockets of the taxpayers to pay for the luxury of a state-owned and operated telegraph system. At present the deficit is more than $4,200,000 a year. Interest on the investment is paid out of the consolidated fund, but even thus the post office is unable to make the telegraphs pay expenses. The reason for this unsatisfactory showing is chiefly the unprogressive and extravagant method of conducting business under government control.—*New York Tribune.*

Shop Equipment.

Pond 42-Inch Car Wheel Lathe.

Several important improvements have recently been made to the Pond car wheel lathe, manufactured by the Niles-Bement-Pond Company. A rough idea of the effect of these changes and others which have been made during the past few years may be gained from the fact that in 1904, the year of the St. Louis Exposition, the machine was capable of turning 6 pairs of wheels in 10 hours and was driven by a 15 h.p. motor. The latest machine is driven by a 40 h.p. motor and has a record of turning 33 pairs of wheels in less than 10 hours. With the latest design the time of handling the work in and out of the machine and of adjusting the work and the tools has been reduced to a minimum, and requires very little physical exertion on the part of the operator. The improvements consist of a power tool clamp, the automatic operation of the gear segment, a new method of traversing the tailstocks, the tailstock clamps and a wheel raising device.

The new power tool rest will clamp the largest tools rigidly and instantaneously by the simple opening of an air valve, thus relieving the operator from all exertion. The air cylinder which furnishes the power for clamping the tool is a part of the lower member of the tool rest. The piston working in the cylinder forces a wedge between a lower fixed roller and an upper roller on the lever end of the clamp itself. The strain on the tool incident to the cut is not carried back to the elastic medium in



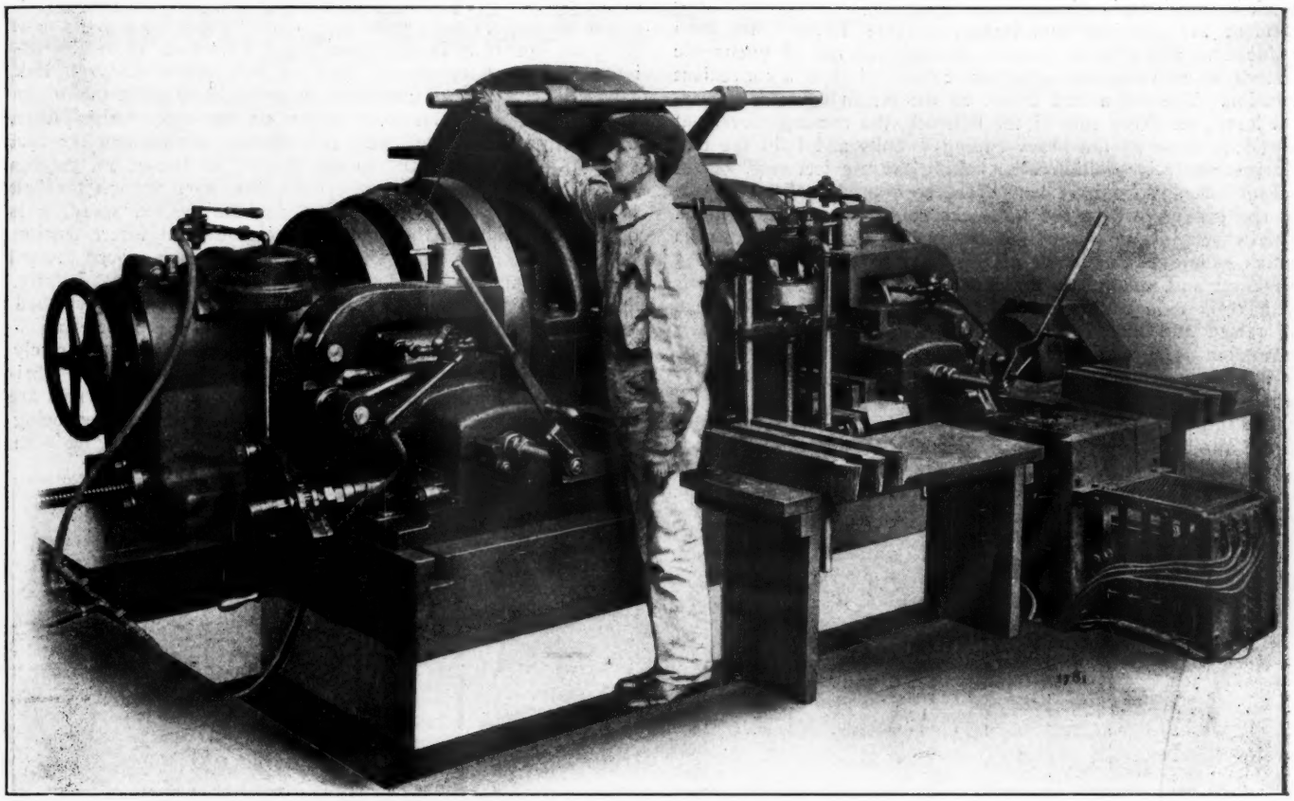
Screw Adjusted, Air Operated Tool Rest.

the cylinder. When the rollers are forced apart by the piston wedge, they remain in that position whether the pressure is maintained in the cylinder or not; thus the clamp is a positive lock. The rest is entirely open at the side and the tools are readily changed without any movement to the slide; in fact, with no extra manipulation of any kind. The power cylinder, being part of the tool rest, offers no obstruction to the view of the work.

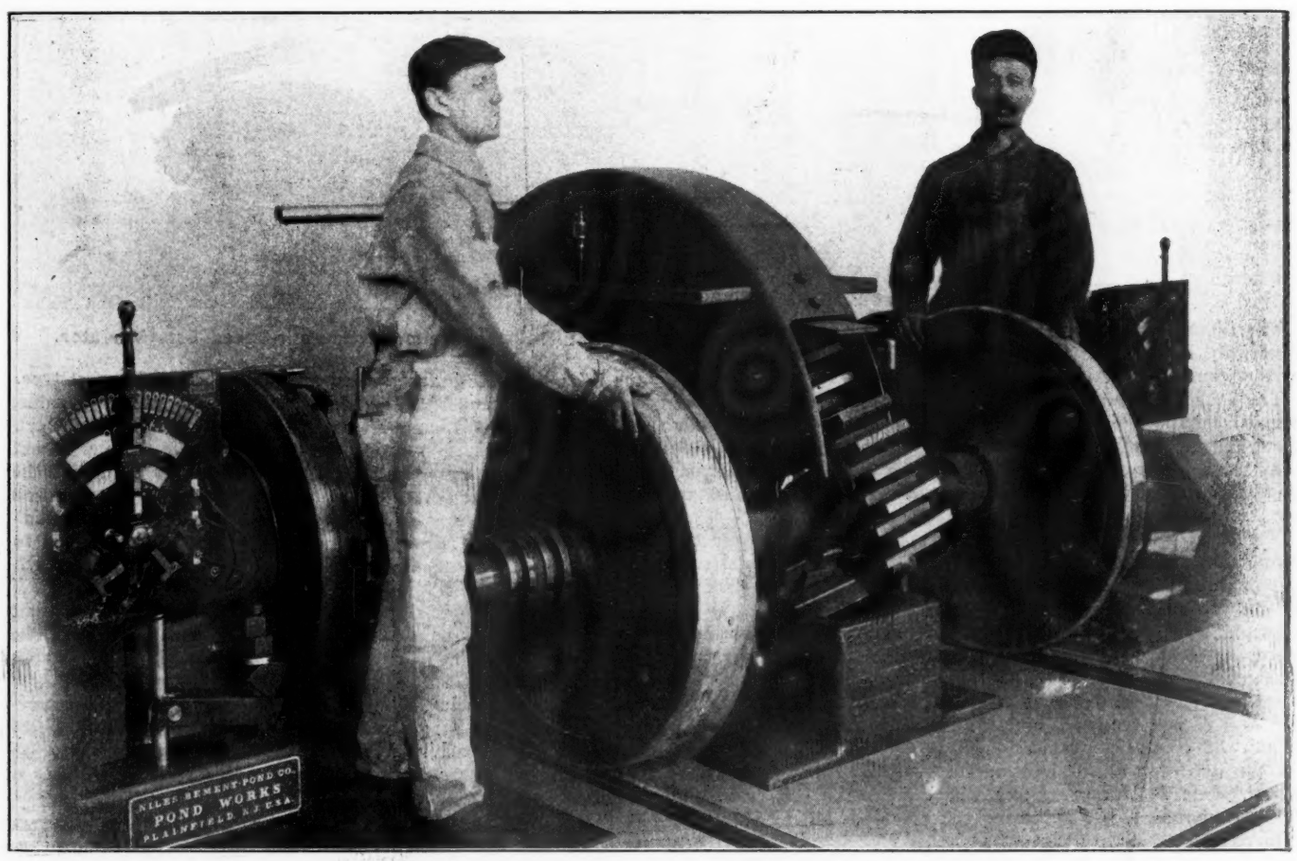
The gear segment is automatically left in an open position when the wheels are rolled out of the lathe. The axle of the next pair of wheels, when it is rolled in, strikes a projection on the underside of the segment, tripping a latch, held in position by a spring, and forces the segment to drop into place. A heavy latch, which may be seen in the illustration, holds the segment in its working position until it is again released by the axle when the wheels are taken out. This not only greatly reduces the time required for putting the gear segment in and out of place, but eliminates all manual labor on the part of the operator.

Much of the time and practically all the labor required for moving the tailstocks back and forth have been eliminated by the use of pneumatic cylinders, which are operated by conveniently located valves.

The lateral pressure on the wheels, as a result of taking heavy roughing cuts. tends to cause the tailstocks to slide on the bed, necessitating the use of four heavy T-bolts to hold each tail-



Pond 42-in. Car Wheel Lathe.



Rolling Wheels Out of Pond Car Wheel Lathe.

Segment of driving gear is automatically opened and held open.

stock in position after it has been adjusted. The time and labor incident to tightening and loosening these T bolts has been reduced to a negligible quantity through the use of pneumatic pistons on each tailstock which are controlled from a convenient location. The downward thrust of the piston operates powerful levers on either side of the tailstock, the rocking movement of which draw up the heavy sliding T bolts and hold the tailstock securely in position when taking the heaviest cuts.

Improvised skids have heretofore been used to lift the axle to the position where the tailstocks could run to the centers. The wheels are now run into the machine on two light rails which extend to the center of the lathe; two pistons, operated by power and underneath the ends of the rails, raise the wheels with their axle to the centers of the face plates. They can be raised and lowered quickly and accurately by the simple movement of a valve. The rails are specially constructed to be as light as possible and are movable so that they will not interfere when cleaning out the chips.

The following tabulation gives the results of a day's run made at the West Albany shops of the New York Central & Hudson River, using a machine of this design in turning 36-in. Krupp and Paige wheels. The average time for turning was 17 min. 58 sec., and the total for 33 pairs was 9 hrs. 53 min.

		Time							
		Putting in.	Rough-ing.	Finish-ing.	Taking out.	Floor to fl'r.	Depth of cut.	Feed.	Speed, ft.
Pair	No. 1	3	11	5	1	20	¼-in.	13/32-in.	16
"	" 2	2	8	6	1	17	1/8-in.	13/32-in.	16
"	" 3	2	9	4	1	16	5/16-in.	13/32-in.	17
"	" 4	3	9	3	1	16	¼-in.	13/32-in.	15
"	" 5	2	9	5	1	17	5/16-in.	13/32-in.	14
"	" 6	2	9	4	1	16	¼-in.	13/32-in.	12
"	" 7	2	9	6	1	18	1/8-in.	13/32-in.	13
"	" 8	3	9	4	1	17	5/16-in.	13/32-in.	18
"	" 9	2	11	7	1	21	5/16-in.	13/32-in.	12
"	" 10	3	10	5	1	19	¼-in.	13/32-in.	14
"	" 11	2	10	5	1	18	5/16-in.	13/32-in.	15
"	" 12	2	9	5	1	17	1/8-in.	13/32-in.	15
"	" 13	4	11	5	1	21	5/16-in.	13/32-in.	13
"	" 14	2	12	8	1	23	½-in.	7/16-in.	10
"	" 15	2	8	4	1	15	1/8-in.	13/32-in.	14
"	" 16	2	9	5	1	17	5/16-in.	13/32-in.	12
"	" 17	4	8	4	1	17	5/16-in.	13/32-in.	15
"	" 18	3	10	6	1	20	3/8-in.	13/32-in.	11
"	" 19	2	8	7	1	18	¼-in.	13/32-in.	12
"	" 20	2	9	5	1	17	¼-in.	13/32-in.	10
"	" 21	3	9	5	1	18	5/16-in.	13/32-in.	14
"	" 22	3	11	6	1	21	5/16-in.	13/32-in.	12
"	" 23	2	9	5	1	17	¼-in.	13/32-in.	14
"	" 24	3	11	6	1	21	5/16-in.	13/32-in.	13
"	" 25	2	9	5	1	17	1/8-in.	13/32-in.	11
"	" 26	2	10	6	1	19	3/8-in.	13/32-in.	14
"	" 27	3	7	5	1	16	5/16-in.	13/32-in.	20
"	" 28	3	10	6	1	20	¼-in.	13/32-in.	15
"	" 29	3	9	5	1	18	5/16-in.	13/32-in.	17
"	" 30	3	10	4	1	18	5/16-in.	13/32-in.	17
"	" 31	3	10	3	1	17	1/8-in.	13/32-in.	16
"	" 32	1	7	5	1	14	5/16-in.	13/32-in.	21
"	" 33	1	10	5	1	17	¼-in.	13/32-in.	18
Av'ge.	..	2:28	9:23	5:07	1:00	17:58	5/16-in.	13/32-in.	14.4 ft.

Four-Speed Belt Variator.

The illustration shows a new multi-speed planer made by the American Tool Works Co., Cincinnati, Ohio, which is operated by this company's new four-speed belt variator.

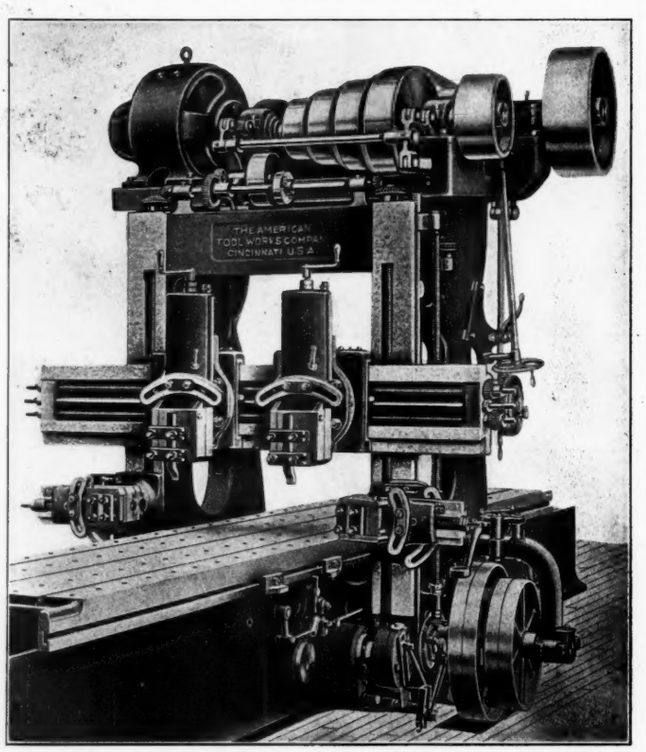
The four speeds are obtained through a pair of opposed four-step cone pulleys, belt operated, the whole being mounted upon a substantial platform on the top of the housing. The variator provides a range of speeds intended to cover the most exacting requirements, which, with the constant high speed return of the platen, insures great working economy.

The drive has two distinct and necessary advantages over the gear drive, viz.: simplicity of design and freedom from destructive vibration. There are no change gears to break, stick to or cut the shafts, no troublesome frictions to wear and to be adjusted, no jaw clutches to be damaged or broken, and no large reservoir from which the oil often splashes and leaks over the machine. This machine is therefore free from the constant noise and vibration of the gear-driven type.

A pair of belt forks are moved alternately along guide rods by a pair of cylindrical cams, which revolve alternately through the medium of a set of intermittent gears operated by a hand-wheel. One revolution of this wheel shifts the belt from one step to another, a pin indicating the complete revolution. The cam rolls have spiral slots milled in their peripheries, each belt fork being moved along the guide rods by a roller operating in the spiral slots. The relation between the cams and forks is so arranged that the latter will shift the belt from the high step of the cone before placing it on the high step of the opposing one.

The tension of the belt is maintained by the vertical lever at the rear, operating in the radial slot. This lever is of convenient height and operates a pair of bell cranks through link connections. The bell cranks serve as levers to guide the driven cone toward the driver, thus slackening the belt. This feature, together with the mechanical belt shifting device, and the fact that the steps of the pulleys are beveled on the edges, permits of easily making rapid changes of speed, even though the belt be very wide. After it is placed for the desired speed, it is tightened by moving the hand lever to the point where tension is sufficient for the work. The driven cone being moved toward the driver, carrying the planer driving belts, is a distinct feature, inasmuch as the tension of the vertical belts is not disturbed when making speed changes, and flying off is overcome.

All shafts in this variator are of large diameter, accurately ground and run in massive phosphor bronze journals, lubricated by the ring or dynamo system of oiling. The journals are supplied with liberal oil wells and return ducts, the idea being to prevent the oil from escaping and coming into contact with



Multi-Speed Planer with Four-Speed Belt Variator.

the belts. All the bearings used are of the ball and socket type.

All speed changes are made without stopping the machine. The driving pulleys have flywheel rims, the momentum of which reduces all shocks to the driving mechanism due to intermittent cutting and reversing, also insuring a steady, even pull at the cutting. They are perfectly balanced, running without vibration even at high speeds. The cutting speeds can be arranged suitable to individual requirements, but are regularly furnished to provide 20-ft., 30-ft., 40-ft. and 50-ft., with a constant return speed of about 80-ft.

Belt drive is regularly furnished with this variator, the tight and loose pulleys being applied to the rear cone shaft. The drive can be obtained direct from a line shaft, provided that it has sufficient speed. If used with similar shafts of about 150 r.p.m., an intermediate or jack shaft is required. The construction of this drive permits converting the belt drive into a motor drive after the machine is installed.

The electric motor drive furnished by this variator requires a constant speed motor for either d.c. or a.c. current. The motor is direct connected to the variator through spur gearing. A starting box provides all necessary controlling mechanism. Should the motor become disabled, the driving gear on the end of the variator shaft may be replaced by a pulley and the planer driven by a belt from a countershaft or another motor.